

HOUSE OF LORDS

SESSION 1990–91

2nd REPORT

SELECT COMMITTEE ON
SCIENCE AND TECHNOLOGY

INTERNATIONAL
SCIENTIFIC PROGRAMMES

VOLUME II—EVIDENCE

Ordered to be printed 12 February 1991

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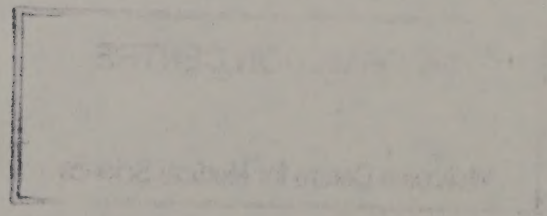
HOUSE OF LORDS
SCIENCE AND TECHNOLOGY
COMMISSION

HOUSE OF LORDS

SCIENCE AND TECHNOLOGY
COMMISSION

SCIENTIFIC PROGRAMME
INTERNATIONAL

SCIENCE AND TECHNOLOGY
COMMISSION



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- (p) refers to a page in Volume II

MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Thursday 28 June 1990

HM TREASURY

Mr D Revolta, Mr C Farthing and Mr M Mercer

*Ordered to be printed pursuant to the Order of The House of Lords of
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TECHNOLOGY

COMMITTEE

REPORT

THE HOUSE OF LORDS

Presented to the House of Lords
in pursuance of a Resolution of the House of Lords
passed on 11 May 1990

MINUTES OF EVIDENCE

TAKEN BEFORE THE SELECT COMMITTEE
ON SCIENCE AND TECHNOLOGY (SUB-COMMITTEE II)

THURSDAY 28 JUNE 1990

Present:

Carver, L. (Chairman)	Nelson of Stafford, L.
Dainton, L.	Nicol, B.
Kirkwood, L.	Sherfield, L.
Lewis of Newnham, L.	

Examination of Witnesses

MR D REVOLTA, Assistant Secretary, Head of Industry and Regions Division, MR C FARTHING, Assistant Secretary, Head of Education and Broadcasting Division, and MR M MERCER, Assistant Secretary, Head of a European Communities Division, HM Treasury, called in and examined.

Chairman

1. Gentlemen, we are very grateful to you for having come here this afternoon to give us evidence at the beginning of our inquiry into international scientific programmes. Would you like to start off by making some form of opening statement? I think that might help us and we would be delighted if you would be prepared to do so.

(*Mr Revolta*) If I may, perhaps I could start by introducing my colleagues. My own job first: I am David Revolta, I am an Assistant Secretary in the Treasury in charge of one of our expenditure divisions which covers the industry programme, mostly DTI and, of course, some Scottish and Welsh work as well. On my left is Colin Farthing, who is in charge of the expenditure division looking after the spending of the Department of Education and Science, and on my right is Mike Mercer, whose division is responsible for the UK interests in the EC budget and some associated public expenditure questions that go with it. With your agreement I would like to make an opening statement. It touches first on the domestic expenditure issue and then on the European Community expenditure issue. The Treasury has departmental responsibility, among other matters, for the level and allocation of total public spending, and public expenditure is, of course, a very important economic variable. But a parallel objective alongside that of planning and control is the need to ensure that public spending offers us good value for money and that departments have procedures in place to deliver this. The principal focus of expenditure management is the annual Public Expenditure Survey, although, of course, there is continuing dialogue on individual issues throughout the year. In addition to that basic position, the individual minister in charge of a department is responsible, of course, for the expenditure of the funds allocated to him in line with collectively agreed policies, and so it follows that the principal responsibility for appraising spending proposals which come forward, both at programme and at project level, lies with individual departments. The Treasury has in many areas agreed substantial

delegations to individual departments and that, of course, is consistent with the general policy drive for good financial management. So while the Treasury is concerned to deliver the twin objectives of expenditure control and value for money, this role is exercised in conjunction with spending departments, which take the lead in evaluating and managing individual programmes. Thus, for example, in respect of the international programmes within the industry budget, the Department of Trade and Industry has the primary responsibility for ensuring that those programmes and projects achieve value for money. The Treasury is not involved in the on-going management of that programme and will only be consulted on large programmes which fall outside normal delegations. There is a similar position in respect of the science budget. The Treasury does not involve itself in the detailed day-to-day management of the science programme, which is the responsibility of the Department of Education and Science and of the research councils themselves. Neither is it involved in the approval of specific projects, either domestic or international in nature, unless certain pre-conditions are met. The most important of these is the size of the project, and others which relate mainly to parliamentary and accounting issues and perhaps appointments and pay are set out in a document which was issued in April 1989 entitled, "Research Councils: Resource Management Arrangements", and that specifies the resource control arrangements between the Treasury, the DES and the research councils. Otherwise it is left to the councils themselves to decide whether or not to refer issues to the DES, who in turn may decide whether or not to involve the Treasury in considering those. To help them decide which issues it would be sensible to refer, the councils are given as guidance a list of issues in which they might reasonably expect DES or the Treasury to take a special interest. These include projects with a significant overseas dimension. In addition, the Treasury is involved in the annual review of research councils' corporate plans and can from time to time follow up specific issues as a means of monitoring the overall effectiveness of arrangements. Your

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MR D REVOLTA, MR C FARTHING
and MR M MERCER

[Continued

[Chairman *Contd*]

Lordships' Committee will wish to note that the Science and Technology Secretariat in the Cabinet Office is responsible for co-ordinating Government policy on science and technology spending and, for example, has prepared a set of criteria for appraising science and technology proposals, which I understand are shortly to be made available to your Lordships' Committee. The position as regards research and development funded from the European Community budget is rather different in practice, although not in principle. The Treasury is directly responsible for the United Kingdom's contributions to and receipts from the EC budget and there are specific arrangements for controlling the associated public expenditure. If I may, I will turn to Mr Mercer at this point to continue the statement.

(*Mr Mercer*) If I may, public expenditure control in respect of European Community spending is a complex subject which can give rise to confusion over both concepts and terminology. The questions which the Committee have kindly sent us refer at several points to additionality and to anti-additionality. I have to say that anti-additionality is not a concept which I recognise in the context of public expenditure management and control. Additionality is, however, a recognisable concept which I take to refer to the question of whether or not receipts from the European Community, or, indeed, from other institutions, lead to an actual increase in the spending power of the body which attracts those receipts. The answer to that question is that such receipts *do* increase spending power in the case of research and development and, indeed, in other cases. The precise means by which such receipts are accounted for varies according to whether they go to the public sector or to the private sector. Almost all receipts in connection with European Community-funded research and development go to the private sector; something like 90 per cent. in total go to private sector as opposed to public sector bodies and they come mainly from the Community's Research and Development Framework Programme. The United Kingdom's contribution to that programme, as, indeed, to all Community expenditure, is around 20 per cent. of the total and it happens, coincidentally, that in the case of research and development we also get back from the Community's programme around 20 per cent. Our contribution to that programme, of course, represents public expenditure. Receipts, as I have said, go very largely to the private sector. So in that sense European Community R&D spending gives rise in the United Kingdom to a significant transfer of resources from taxpayers, who foot the bill for our contribution to the Framework Programme in the first place, to bodies such as research associations and universities. What all this leads to is a strategic question of how far that transfer of resources should add to planned levels of public expenditure or, alternatively, be offset by changes elsewhere within the system. That is a question which is addressed in the context of the annual

Public Expenditure Survey to which David Revolta referred. The fundamental principle is that departments are required to bid for and to justify on grounds of value for money any expenditure in excess of planned, pre-determined levels, and that is a principle which applies to all forms of public expenditure. Contributions to European Community programmes are no exception. Indeed, it would arguably be illogical if they were. All such bids are then considered on their relative merits in the course of the Public Expenditure Survey.

I think I would conclude by saying only that it is important to note that bids are required simply to cover the United Kingdom contribution to Community expenditure above predetermined levels. What this means, as indeed is already the case, is that European Community R & D spending inevitably leads to substantial additional public expenditure devoted to research and development. For example, the recently agreed EC R & D Framework Programme covering the period 1990-94 will mean an increase of at least £250 million over the next seven to eight years in the level of publicly funded support for the United Kingdom's research effort. Indeed, depending on decisions by Ministers in the context of successive annual surveys that increase could be greater still.

(*Mr Revolta*) That is all we would like to say in our opening statement.

Chairman] I think, rather than get bogged down on discussions of additionality and anti-additionality on which you have given evidence also to another Committee of the House, perhaps we could return to that later unless there is some clarification of exactly what Mr Mercer said which any of my colleagues would like to seek.

Lord Dainton

2. May I ask a question? I am not sure that I understood, it is a complex procedure. But there is a department X: did you say this department X makes a bid to the Treasury in order to make a contribution to the EEC?

(*Mr Mercer*) It is not quite that. The contribution to the Community falls on a separate public expenditure programme for which the Treasury is responsible.

3. Then allocated in parts to departments?

(*Mr Mercer*) No, attribution of responsibility for particular R & D programmes goes to departments in line with their domestic policy responsibilities. Those departments are then responsible for briefing and negotiating upon and advising on the content of European Community programmes. Each department also has an expenditure allocation, a financial allocation, related to its sponsorship responsibility, if you like, for European Community programmes. If expenditure on those programmes—on the programmes for which the department is responsible—exceeds the predetermined level of provision which the department has, then that department is

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MR D REVOLTA, MR C FARTHING
and MR M MERCER

[Continued

[Lord Dainton *Contd*]

expected to contribute towards that excess European expenditure. In effect, the department is expected to meet the net public expenditure cost of the United Kingdom's contribution to the EC expenditure above the predetermined level. But the existence of the predetermined level means that European Community research programmes will always give rise to additional public expenditure in the United Kingdom; and since our receipts broadly equate with our contribution, that additional public expenditure will mean an increase in the resources available to research institutions in this country.

4. One further question to get it absolutely clear: the nation as a whole through the Treasury makes a contribution based on GDP to the Community?

(*Mr Mercer*) Based broadly on GDP, yes.

5. A set figure, nothing to do with the departments or anything else?

(*Mr Mercer*) Nothing.

6. Then a time comes when a department receives through some process from the Community some money, and am I right in saying, if that money is judged to be, as it were, giving them something in excess of some predetermined figure they have used in their bids to you earlier on through the PES process, you levy on them some charge?

(*Mr Mercer*) It is not quite that, because the receipt, when it comes from the Community, will in almost all cases so far as R & D is concerned—and R & D is a fairly distinctive thing—will go direct to private sector bodies, research institutions in the private sector; it will not flow through a central government department. Only some 10 percent of R & D receipts from the Community come into a public sector body. So it will go straight to the private sector body concerned and the private sector body will get all the money. The department in whose area that research happens to fall, to the extent that the European expenditure in question exceeds that department's predetermined level of provision to cover excess European expenditure, would be expected to meet the net public expenditure cost of the United Kingdom's contribution to the European expenditure in question.

Chairman

7. Could I get it absolutely clear? Following up what Lord Dainton said if, out of the money which we have through the framework programme provided, the European Commission places a research contract, shall we say, with British Aerospace, then the Department of Trade and Industry, because it is the sponsor department for British Aerospace, would from the Treasury point of view be debited with the money that had gone from the European Commission to British Aerospace,

even though the Department of Trade and Industry itself would not have had any intention of placing a research contract with British Aerospace?

(*Mr Mercer*) That is broadly correct, subject to two observations. Firstly, to take the case you outline there, the Department of Trade and Industry would not be debited for the whole amount; it would only be debited for the amount above a pre-existing level of provision. If you like, there is a sort of tax allowance which—

8. Therefore it would be the pre-existing level and the Department of Trade and Industry would not have been intending to place a research contract with British Aerospace on that subject?

(*Mr Mercer*) No, the responsibility for the totality of the European Community Framework Programme is split between departments and each of those departments, because of their responsibility—

Lord Dainton

9. Sorry to come in. When you say "split", you allocate to departments fractions of that total sum?

(*Mr Mercer*) It is not allocated unilaterally by the Treasury but by the Treasury working in conjunction with the Cabinet Office and others, but yes, indeed, split on a proportionate basis.

Chairman

10. You look at the framework programme and say, "Well, I think most of this goes to DTI and some goes to DES and some to something else"?

(*Mr Mercer*) On an agreed basis that is what happens—in agreement with the departments concerned. It is not imposed upon them but is part of a process of negotiation and agreement. That department then has, as I say, responsibility for policy advice upon the programmes in question, for negotiations and all the rest of it. But in addition the sponsorship responsibility is accompanied by provision intended to cover part of the cost which that department would otherwise incur if it were debited for the full amount of the United Kingdom's contribution to the programmes in question. The department therefore is debited only to the extent that the European Community expenditure, the actual expenditure out of the Community budget, exceeds this allowance, if you like, which the department has. It is the existence of that allowance which always means that the United Kingdom's receipts from the programme will be greater than the amount by which a department's programme has been debited and, therefore, that the existence of the Community programme will lead to a genuinely additional amount of income for the private sector research institutions in question.

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MR D REVOLTA, MR C FARTHING
and MR M MERCER

[Continued

Lord Dainton

11. But the department itself suffers a loss of funds in this process and also loss of decision-making because decisions are taken in this area elsewhere.

(*Mr Mercer*) It suffers a loss of funds which, of course, it is free to bid to have reinstated during the course of the annual survey.

12. Does that happen?

(*Mr Mercer*) Certainly such bids are made and they are considered on all fours with any other bid in the annual survey from wherever that bid may come. But the fact, as I say, that there is a level of provision for which the department does not have to bid, which is there as a bedrock means there will always be some increase and, as I have tried to show in the opening statement, quite a significant increase in relation to the Research and Development Framework Programme. There will always be some increase in the net flow of funds to research institutions.

Lord Lewis of Newnham

13. But if you are saying that roughly speaking we are putting in 20 percent and getting 20 percent back again, then it must mean there are occasions when people who are bidding above suffer and people bidding below presumably would benefit, so there must be a direct move in the other direction.

(*Mr Mercer*) I think the answer to that depends largely on the extent to which in negotiation on successive Community Framework Programmes we manage to align Community and United Kingdom priorities. I think it is fair to say that in successive Framework Programmes—we are now in our third—there has been a significant degree of correspondence between the objectives which underlie the Community expenditure and the objectives and priorities which underlie expenditure which would otherwise have been funded domestically in the United Kingdom. What that means, in effect, is that when departmental programmes are debited on account of the United Kingdom's contribution to Community expenditure, there is a degree of substitutability between the Community grants that are going to research institutions and what would otherwise have been domestically funded grants going to research institutions.

If you like, it is the converse of saying that Community money can never substitute for United Kingdom money, which arguably would lead to a considerable amount of duplication of effort.

Lord Dainton

14. Could it happen that in the case of, for example, the research councils coming under the Department of Education and Science the amount of money which might come to them from the Community might be so large that, in fact, when the

levy is made, or whatever you call it—the terminology does not matter—it would have less money than it otherwise would have had had there been no Community money to have control over itself?

(*Mr Mercer*) I think the answer to the question posed in that way is no, because the amount of money which the department loses, if you like, is not related to the scale of the receipts of a research institutions for which that department is responsible.

15. This is an extremely important reply, Chairman.

(*Mr Mercer*) I think ironically one could get a situation where a research institution was receiving relatively modest amounts and its budget was being affected by potentially significant reductions in a department's programme. You could at the margin get mismatches like that and it is precisely the fact that all this goes into the annual Survey process, which is designed to try and prevent such mismatches. They do occur inevitably at the margin. There are always areas in public expenditure where shoes pinch.

16. Is there an appeal procedure and is there a carry-over from year to year?

(*Mr Mercer*) The Survey procedure itself, I think, can be construed as a form of appeal procedure in this sense.

Chairman

17. Thank you very much. Of course, we are not concerned just with the European Framework Programme. Perhaps I could start off by asking you how, in fact, does the Treasury hear about proposals for international science projects and does the Treasury itself attempt to assess a balance between the advantages and the disadvantages of taking part in an international scientific programme? I remember well a great deal of argument about the ocean drilling programme. How do you first hear about it? Do you hear about it from the Department of Education and Science or the DTI or somebody because the sum involved is significant, and if so, what is meant by "significant", or does almost everything have to be referred to you?

(*Mr Revolta*) If I may tackle that question first, Lord Chairman; as I think it follows from my opening statement, the Treasury will not routinely hear of projects which come up, and perhaps I should say that we have, in looking at the terms of reference of your Committee, looked at the term "international scientific projects" in a very broad sense to cover technology as well as science itself. The Treasury will hear of a particular project normally if that follows from the delegated financing arrangements between the Treasury and the department concerned. It is a truism, of course, that the Treasury cannot be involved in more than a

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MR D REVOLTA, MR C FARTHING
and MR M MERCER

[Continued]

[Chairman Contd]

fraction of what a department is doing, and it also follows from the Government's general concern for effective financial management that we tend to delegate substantial quantities of spending to departments if we are satisfied that they have their proper control systems to ensure that projects are properly appraised and that they will offer value for money. So against that background we expect to hear of a project which came up probably, I would say, on an exceptional basis—my colleagues may wish to comment on that—but in general that will be measured against any particular delegated limit that has been agreed with that department and that delegated limit in turn, frankly, will reflect their track record of their competence in appraising projects which have come along and the degree of professionalism with which they do it.

(*Mr Farthing*) That is certainly true of the science budget, which is the area with which I deal. We have an arrangement with the research councils which is governed by the document which David Revolta mentioned, which was issued last year, called, "Resource Management Arrangements" which indicates when the research councils are required to refer projects to us, either domestic or international.

18. If they are over a certain amount?

(*Mr Farthing*) That is one of the criteria, yes, if they are over a delegated level, also if they raise a particular Parliamentary or accounting issue, and there is also another range of factors which we and the Department of Education and Science tell the research councils that we are interested in, and if projects arise that they think might come into one of those categories, it is then at their discretion whether or not they choose to refer it to us. So our experience is the same as in industry: that we do not get involved in the great majority of projects in any detail.

Lord Dainton

19. Do these delegated limits vary from research council to research council?

(*Mr Farthing*) No.

Lord Lewis of Newnham

20. Do they in any way vary depending upon any allowable limitation on timescale, either a one-year or a ten-year or a 20-year?

(*Mr Farthing*) One of the factors that we would want to be consulted about is, for instance, on a project with a very long life. We do not tie it down to particular years, but anything that goes beyond the Survey period is treated differently from something that lives within the Survey period.

Chairman

21. But how do you assess at the beginning of one of these? I remember the great argument about the ocean drilling programme. When the thing is first put to you, having made the commitment, how do you assess it? What happened over the ocean drilling

programme was that it was halfway through and suddenly somebody said, "We are not going to take part in it any more," and then they changed their minds. Do you insist that the research council—in this case it must have been NERC—try and make an estimate to you of what the on-going cost is going to be or do you just look at it from the point of view of the next few years?

(*Mr Farthing*) If it were a project that were going to run for a long period of time, then, yes, we would want to know that they had taken account of the long-term consequences of it. The nature of most of these projects—and this applies to other governments as well as the British Government—is that, although they are planned to run over a long period, they do tend to have break-points or limitations in them. Subscriptions are agreed for only a year or two years ahead, so that there is no formal commitment that goes beyond two or three years in most cases. But yes, if a research council was entering into a commitment or entering into an arrangement that was likely to involve commitments beyond the PES period, we would take account of that and we would want to be satisfied. They themselves produce corporate plans and what are called forward looks which do tend to deal with this kind of issue, to give them some perspective for their own purposes of what kind of commitments and projects they are going to be interested in beyond the three years of the Public Expenditure Survey, and we are involved in that process. We see copies of their annual documents and try to ensure that the programmes they do enter into are reasonable in terms of the likely expenditure they are going to get, but the Councils are aware of that as well. It is not simply that the Treasury needs all the time to remind them of this. They themselves realise that they have to live within a budget and the Department of Education and Science realise they have to live within a budget. So the processes we adopt are really no different from the processes that the department adopts or the individual research councils adopt. It is simply that we tend to get involved in the more contentious or the larger issues, but the process of assessing and dealing with those is not fundamentally different.

22. How do you assess the national interest in this, for instance? In many of the studies we have done we hear at first hand people saying—it appeared on the space programme, it appeared on marine science, it appeared on the environment—that we cannot possibly hope to do all this ourselves and, therefore, we must take part in an international programme. At the same time it is said to us that it is very important, when taking part in an international programme, that we should have a strong, sound and good base of that science in this country if we are to get something out of the programme and that involves expenditure. On the other hand, one tends to get the impression sometimes that in certain circles of government it is

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and MR M MERCER

[Continued

[Chairman Contd]

thought that the object of taking part in an international scientific programme is that this country should not have to spend any money on it.

How do you determine when looking at the proposal put up, say, by a research council or by a department, where the balance in all this lies?

(*Mr Farthing*) I am not sure that we do to a very great extent. The basis of the decision is the research council's own views. They look at it, I think, from a scientific point of view rather than an international or diplomatic point of view, they are interested in pursuing the work in a particular area of science. They initially decide whether it is more profitable to pursue that work domestically—

23. When you say "profitable" what do you mean?

(*Mr Farthing*) More profitable in terms of advancing science, not making a financial profit.

24. It is a very important point. You mean by "profitable" good for science?

(*Mr Farthing*) Yes, good for science—how best they can pursue a particular line of study, how they can do it most effectively. They have in most cases three choices before them: they can do it domestically, they can join some existing collaboration that is already in place in this field, or they can seek to create a new collaboration for a new area of study. The decision about which one of those three options they adopt is very largely for them to decide. The Cabinet Office document Mr Revolta referred to earlier gives guidance about the kind of issues that ought to be borne in mind when taking that decision, but within that context they come to a view and then decide in a particular case the thing to do is to set up an international collaboration, or whatever. As I say, in the majority of cases they would then go ahead and do that if the sums involved were not too large and if it did not raise any other difficult or contentious issues. In those cases where it was necessary to refer it to the Department of Education and onward to the Treasury, we would not tend fundamentally to question their scientific judgment, but simply to see that they had gone through the assessment procedures properly and taken account of the relevant factors, and that the decision they had come to was a reasonable one and one that it was reasonable for them to undertake within the level of expenditure that was available to them. That I think is the extent of our interest and, if we were satisfied on those issues, we would be happy for the project to go ahead.

Lord Nelson of Stafford

25. Could I please be clear as to exactly where the Treasury comes in?/ If an authority or department has it in mind to go into an international collaborative programme and it is within their own budget, am I right in assuming the Treasury does not come into it at all?

(*Mr Farthing*) Yes, unless, as I said, there was some other contentious factor they thought it would be necessary to consult us about, if there were some parliamentary or legal commitment or something of that sort. In the great majority of cases you are right.

26. Then the converse is supposing it is outside their normal budget: for instance, if the Atomic Energy Authority went into some big nuclear programme on a collaborative basis which was outside their normal budget, the Treasury would come into that then, would they?

(*Mr Farthing*) Yes. It is a question of being above a delegated level of expenditure. Mr Revolta deals more with industrial issues. I deal predominantly with research councils. Outside of that I am not familiar with the mechanics but I think the procedure is the same in all cases. The level of delegation which may vary with types of activity, but within that level of delegation, all things being equal, the body can make its own decision. Above that level of delegation it then has to be referred first to the sponsoring department and then onwards to the Treasury.

Lord Nelson of Stafford] If additional money were required, it would come up for decision as to whether this was worthwhile doing from a national point of view, bearing in mind that it would be competing on priorities presumably with some other demand for the same funds. What is not clear to me is how that is evaluated, as to whether it is a good thing to do or is not a good thing to do.

Baroness Nicol

27. Does the Treasury have advice from anyone other than the applicant, so to speak?

(*Mr Revolta*) Perhaps I could attempt to answer those two questions and return to the question you yourself asked, Chairman, a few moments ago as to how we actually appraise a case which comes to us. The Treasury will adopt what I can fairly describe as standard investment appraisal techniques. By standard I mean those which are used across all government departments and public bodies and the Treasury has published explanatory booklets on how this is done. I am sure your Lordships' Committee will be very familiar with the basis of economic appraisal where we are attempting to assess costs and benefits. Of course, it is a common feature of a major appraisal of a major project that there will be some items which cannot of themselves be quantified or which can only be described as judgmental factors and it is certainly the case in the appraisal of any major project which comes to my division that I would expect to be dealing to some extent with factors of that kind. They will quantify what they can and will make their additional non-quantified arguments. I think it is also worth pointing out, as I think my colleagues have mentioned, that there is a formal level of delegation based on a particular financial sum, but it is, of

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course, open, looking for example at the Department of trade and Industry, to the Minister in charge of that department or that particular bit of spending to make his case to his colleagues and his Treasury colleagues on the merits of the programme as a whole; and it is entirely possible that a programme which came within his delegated budget might be quite a large one but within his limits he would wish to raise it with his colleagues for general or political reasons, for policy reasons, and it is of course quite possible that he might feel he wanted to bid for some additional expenditure for that in the annual survey and negotiations. So I would not like your Committee to be left with too mechanistic an impression of the way this will work. We set out formal guidelines which exist, but as is often the case with government there are some rather more flexible bits at the edge and I think it must commonly be the case that if a major project is in the offing, then certainly at a political level information about this will be available and in the normal course of exchanges, for example, with our finance colleagues in departments we might well hear mention of it. It is then, of course, for decision by the department as to whether they wish to pursue it by saying "We can handle this within our delegated limits" or whether they wish to handle it in a rather wider way in government.

Lord Nelson of Stafford

28. Does the same sort of control apply not only to government departments but to nationalised industries—British Rail, British Coal, the UKAEA? Take the UKAEA as an example: if they wish to take part in some international scientific or technological project of this sort which could involve perhaps expenditure of a considerable amount of money in another country, would that come to you and would that be subject to your approval?

(*Mr Revolta*) The principles are essentially the same because, of course, nationalised industries are public corporations and they are within the public expenditure system and typically their finance will be controlled by an external financing limit. There will also typically be a system of delegations in respect of either the size of an investment project or the rate of return which it should earn at the point of appraisal. It follows from that that there would be certain projects from the corporations which you mentioned which would come through the sponsor departments to the Treasury, but the background against which that would be done is essentially the same as we described for mainstream government departments.

29. In all these projects do you take into account the advantages that might flow back into this country from some of them from the technical exchange point of view or is that likely to be so marginal as not to be worth thinking about?

(*Mr Revolta*) That is something that has always been thought about, Lord Chairman. I think you are referring to the fact that one might refer to export

flows or import flows or financial flows in foreign currencies. Where those are a measurable or significant feature of the project, then they will be assessed as far as it is possible to do so. I think it is worth commenting that for major projects which have a fairly substantial life—possibly five or ten years—the consideration which is given to those sorts of arguments about export or import flows will tend to be at the margin because the effect which those sums might have over that period of time is of course very greatly outweighed by other macro-economic developments.

Lord Dainton

30. One point I would like to ask—and in a sense the mention of exchange brings us to it—is that some of these projects are costed in ECUs; at least the EC money coming in is initially evaluated by them in ECUs, is that right? You need not answer that if you do not want to, but the problem which I want to get to—whether they do or not, but I was trying to make it simple for you—is how one copes with the problem of fluctuating rates of exchange for a research council? Do you make any kind of compensation for this on a year-by-year basis if it is adverse, and correspondingly, if it is beneficial do you make a corresponding reduction, so that the research council can rely, when it has entered into a contract, on having an amount of money in the future, a tranche of money, which it has to pay and which it knows ahead of time? Do I make myself clear?

(*Mr Revolta*) Absolutely, yes.

(*Mr Farthing*) There is no formal mechanism. As I say, the decision to go into an international project or into a domestic project to pursue a particular piece of science is a decision taken initially by the research council. The costs involved in buying foreign currency and the risk element of currency fluctuations are relevant factors to be taken into account and the research councils do that. In the case, certainly, of the larger projects the amount of fluctuation is limited by the arrangements that are set up between the participating nations to decide what the annual subscription will be, and a number of these, for example CERN, take account of movements in GDP and take account of currency fluctuations, and the research councils themselves, once the sum has been set in the foreign currency or whatever it is, will then attempt to manage the problems related to fluctuations by market mechanisms, by buying currency forward. Certainly in the case of CERN, which is the largest subscription that we pay to one of these bodies, the research council in that case, SERC, does buy currency forward, so that they are not themselves a prey to fluctuations in movements of currency at the time because they have already bought their Swiss francs, or whatever, in advance.

31. But equally well, if the currency goes against them they are the loser?

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(*Mr Farthing*) That is a decision they have to take. There are guidelines that the Treasury lays down about the way in which this can be done and bodies can choose whether to buy forward or to buy at the time. In this case, SERC has decided to buy forward and has been doing that for the last few years. As you say, there may be notional movements either way but at least they are not unexpected movements because they have taken management steps to even out any of these problems.

(*Mr Mercer*) Could I add in relation to the European Community money, since I believe you specifically mentioned the ECU, that European Community research contracts, although denominated in ECU, are payable in national currencies at a pre-determined, fixed exchange rate, so that the recipient will always be sure from the day the contract is signed of how much he is going to get in his national currency. To that extent I suppose it could be said that the exchange risk is borne on the Community budget rather than by the recipient.

Lord Lewis of Newnham

32. But that does not apply, as you are saying, to a research council dealing with, say, the establishment of something like CERN. Could I ask what would happen in France or Germany? Do they have a similar arrangement or do they get more of a guaranteed arrangement as with the ECU?

(*Mr Farthing*) I do not know, is the short answer. What I can tell you is that the arrangements in terms of who pays the subscriptions are different in different countries. As I have said, it is the research council, SERC, who pays the subscription in the United Kingdom. The French and Swiss subscriptions to CERN, as we understand it, are paid by their Foreign Ministries, the Italians and the Dutch pay through their Ministry of Finance or Economic Affairs, and the Germans, the Belgians and the Swedes contribute through their Education and Science Ministries. So the system seems to be different in different countries, but how the ministries themselves then deal with the consequences of currency fluctuations I do not know.

Chairman

33. The suggestion has been made that fluctuations should be covered by the Contingency Fund. Does that find favour in the Treasury?

(*Mr Farthing*) As I said at the beginning, we see the cost of the uncertainty caused by currency fluctuations as being one of the costs that a body should take into account in deciding whether a domestic or—

34. Although it has no say whatever in either micro- or macroeconomic operations?

(*Mr Farthing*) No, but it does know that if it goes into an international project than there is this

additional factor to be taken into account that does not have to be taken into account in a domestic solution to the problem.

Lord Lewis of Newnham] Would it not be wiser for the Treasury, with all its experience of this particular issue and knowledge, to take this particular role over?

Chairman

35. Like its great accuracy in forecasting inflation!

(*Mr Revolta*) Chairman, if I may direct myself to the question that you yourself have asked about the use of the Contingency Fund, as you know, we guard our funds jealously and I think my answer to that is that we would not think it was a particularly good idea to take these sorts of risks with the Contingency Fund, the particular reason being in respect of that fund that it is designed to provide a short-term, effectively emergency reserve, and the point of crucial importance about it is that it provides cover until formal supplementary estimates can be presented to Parliament; so that, in respect of the Contingency Fund, is why it would not be suitable for the proposition which your Lordships have been putting to us. As to the wider proposition of whether the Government should protect spending by UK public authorities or government departments from the effects—

36. I am talking about research councils in particular.

(*Mr Revolta*) Indeed—from the effects of exchange rate fluctuations, I think all I would say is that, as we have explained, current policy is that that is taken as one of the pluses and minuses within the flow of finance to those bodies. Currency movements can, of course, go in either direction.

37. Yes, but what you are really doing is encouraging the research council to gamble, are you not?

(*Mr Farthing*) Not really.

(*Mr Revolta*) I would hope not.

38. Would you not really?

(*Mr Revolta*) No, I would say not, with respect, my Lord Chairman. I think we are encouraging them to take some carefully calculated decisions about the merits of particular projects. They may take the view that international collaboration will deliver a certain—

39. No, I mean gamble on the effects of currency fluctuation.

(*Mr Revolta*) Indeed, and they may take the view that a particular international project will deliver their scientific objectives better. The decisive issue here is whether the effect of those currency

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fluctuations in both directions over the life of the project is likely to be a significant criterion in deciding whether they go into it in the first place, and our general view would be that certainly with the medium- to long-term project, whatever the movement of the currency, particularly in one direction, the research council, given, of course, that it has wider projects generally, would be unlikely to find great difficulties in coping with the effect of currency movements.

Lord Nelson of Stafford

40. Could I turn the questioning on its head for the moment and ask our witnesses from the Treasury, are they satisfied with the method by which decisions are arrived at as to whether we participate or do not participate in international programmes, and if they are not satisfied with it, do they have any views as to how the decision-making could be improved?

(*Mr Revolta*) I think that is something we would hesitate to express a view on but perhaps I can respond to the question as put. I think what we look to the departments or the sponsoring bodies to do is to take a decision on a potential project which relates that decision by measuring, on the one hand, the objectives of the project that has been put to them and, on the other hand, the objectives that they themselves are pursuing, whether it is scientific research or technological research.

If they have examined those issues properly and if they have done a thorough economic appraisal, then I think it follows that we would be broadly satisfied that the present arrangements deliver a sound decision.

41. What about the projects which could have an effect on more than one department? I think that is a thing which probably worries us more than anything else, that a decision may be taken in a department on whatever grounds appropriate to that department whether it be science, trade or international interests and so on, but where that involves two or three departments who may have a feed into this of some sort or other, we cannot see—or have not seen up to now—any mechanism for doing that. We can see it being evaluated in a single department when it is a single department issue, but very often it is not a single department issue, it is a multi-department issue. What is the mechanism for bringing that all together?

(*Mr Revolta*) If I may, perhaps I could start on the answer to that question. Let us suppose we are talking about a project proposal below, as it were, the average delegated limit and which therefore the Treasury is unlikely to hear of.

Chairman

42. A very good example might be something to do with the environment which affected both the Department of Energy and the Department of the Environment.

(*Mr Revolta*) Absolutely, yes. Let me start with the other half of the equation. If it is above the delegated limit the Treasury will hear of it and the Treasury, by definition, is in quite a good position to assess what other departmental interests there may be and can ensure that they are taken into account. But in respect of a project below a delegated limit your example, Lord Chairman, might be quite small and I think my response would be that one cannot actually legislate for departments behaving in a sensible way. But it must be the case, I would argue, that they are aware of the interests of the other departments, other research councils, other bodies—they certainly talk to each other plenty—and in those circumstances I would be very surprised if the normal mechanisms of government consultation did not bring the various interests together at a suitably early stage.

43. This would go to Cabinet Office?

(*Mr Farthing*) There is, as you know, in the Cabinet Office a secretariat that deals with the larger issues. It is a question of scale and size. If it was a subject like the environment, which currently is topical and where a large number of departments have an interest, something of that sort is much more likely to be seen across the wide range than a much more narrowly defined, smaller, esoteric subject which was largely the responsibility of one department although two or three other departments might have marginal interest in it. But I think I agree with what Mr Revolta has said: there are a lot of both formal and informal contacts that go on. In a lot of work that research councils do—they do it on behalf of other government departments—so they become aware of what the interests are of other government departments. There are a lot of informal scientific meetings and people move from universities to research councils and so on. So within a subject area there is a pretty good knowledge of who else is interested in an issue and in most cases, because those who are doing the work want to do it in a way that maximises the benefit of a particular line of study, the tendency I would think is more to inform people who might be interested rather than to ignore the views of people you know to be interested.

Lord Nelson of Stafford

44. What you are saying to us, if I interpret it correctly, is that you are satisfied that the informal arrangements take care of the inter-departmental interests on these issues, are you?

(*Mr Revolta*) I think I would say we would be foolish to be ever fully satisfied with any administrative arrangements. On the other hand, I

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think to describe the consultation we have alluded to as informal is perhaps doing it a little bit less than justice. I think, for example, departments in the nature of things consult with each other a great deal and you might say that formal consultation only took place when, for example, there was a formal committee set up; and I think to say that any consultation less than that was not adequate to the purpose would be an injustice to the normal flow of discussion between departments. So I would not wish to sound complacent. We have described what I am sure is familiar to you as the normal kind of consultative arrangements between departments. There may occasionally be flaws, I would not deny that.

Chairman

45. Could we change to a different subject altogether, the question of the advantages and disadvantages of hosting international scientific projects in this country. We have JET although its life is limited. What is the Treasury view on this? France seems to think it is a good thing to host international scientific projects. Have the Treasury got a view about this, that it is a good thing or that it is a thing to be discouraged?

(*Mr Revolta*) If I may start on the answer to that one, my Lord Chairman, the Treasury I think has a fairly neutral position on this. Our principal concerns are the proper control of spending and value for money of the projects and those are the criteria we bring to bear when a project comes to us. I would not care to guess at the criteria which other countries sometimes bring to bear. It will, of course, often be the case abroad, as in the United Kingdom, that once you have gone through the economic analysis, if the matter is coming up for ministerial decision, ministers will form their own broad judgment, but as far as the Treasury is concerned the position is as I have described it to you earlier.

Lord Lewis of Newnham

46. Does that not mean then in general you prefer the short term rather than the long term project?

(*Mr Revolta*) I would argue not, the point being that, if you have a project which is long term and the outcomes of which are relatively certain—and perhaps Mr Farthing would care to comment on some projects in a moment—that is, I imagine, by definition more difficult than where the outcome is reasonably certain.

Chairman

47. How can it be long term and the outcome be reasonably certain?

(*Mr Revolta*) I agree those two can go in opposite directions, but there may be projects in particular areas, areas of technology, possibly defence technology, where you know the product you are aiming for and may be reasonably certain that you

can deliver it. Under those circumstances then we would expect a project to score reasonably well, particularly as I have mentioned earlier as the appraisal sets out the non-quantifiables and judgmental factors as well as those which can actually be quantified. But it must be the case, as you suggested, that if the short term is more predictable than the long term, then certainly in terms of the figures in the appraisal a short term project may be stronger than a long term project.

48. In the case of JET, for instance, when Jet is finally finished and the whole question of clearing it all up and dealing with the site and everything is finished, shall we be up or down in the accounts?

(*Mr Revolta*) I would not care to say, Lord Chairman, because I am not an expert on that particular project. If the public purse is down on the whole deal across the whole life of the project, then we would want to look very carefully at why it was that that had happened, whether the original decision was in some way flawed or whether circumstances had actually overtaken the project midstream in a way which could not have been predicted. I understand the JET project is regarded as having produced some very valuable scientific results in the course of its life and the issue now is the close-down costs which are particular to that kind of project. But certainly it would be incumbent on government to learn lessons from that sort of experience if we ended up with in financial terms a negative result.

49. Without going into terribly complicated detail, how do you work out the amortisation of the capital costs of some major scientific project which would be set up in this country as an international project? Would you expect contributions to the capital cost in the first stages to come from the other participants or would you expect to recover it over the years?

(*Mr Farthing*) I think in the case of research council projects—and there is no difference in the way the international ones within the United Kingdom work and the way the international ones work outside the United Kingdom—a contribution is expected from the participants from the first, so that it is always a joint project, it is not a situation where one country builds it, then everybody else comes in.

It may be the case that other participants will come on board further downstream, but in the majority of cases that I am aware of a quorum, as it were, of participants has been available from the first. They have met the initial cost of the project as well as the running costs of the project once it is operating.

50. But in general, looking over the whole field, do you think that from your point of view you encourage free British participation in international

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scientific projects or do you view it with the traditional cynicism of the Treasury about expenditure of any money, or do you discourage it?

(*Mr Farthing*) I do not think we do either. As I say, the perspective is not from the point of view of whether it is international or whether it is domestic. The perspective is from the point of view of whether this is the best way of achieving a particular piece of study. In something like CERN, where the scale of the project is enormous and the amount of research in terms of manpower and money and size is very large, then the decision was taken, and has been confirmed again and again, that the international route was the right way. In smaller projects it is very often much easier and much simpler to do it domestically, and in the very large number of projects that are in the range between those two extremes, the research council initially has to take the judgment on the facts available at the time as to which is the best way to do that piece of science. Sometimes the answer comes up international and sometimes the answer comes up domestic, and provided they have followed the right assessment procedures in coming to their decision, we would be happy with the decision whichever way it went. We do not have a predisposition either way.

51. Do you ever say to a research council or anybody else, "Look, you are proposing to spend an awful lot of money on this. Why don't you try and do it on an international basis?"

(*Mr Farthing*) In assessing the options put to us we would argue it both ways, yes. If it seemed to us that there might be a more effective way of doing the work internationally and they have chosen domestically, or conversely, if they had said they were very keen to go into international collaboration, When it seemed to us it might be easier to do it domestically. That is really what I meant by saying satisfying ourselves that they have gone through the procedures properly and analysed all the options correctly, but we do not have a predisposition for international or domestic.

Lord Sherfield

52. But the advantages of having an international headquarters in this country are not entirely financial. There are a number of other political, imponderable questions which come into the decision, but I take it that the Treasury feel that they are just concerned with the financial aspects and are not concerned with the other factors and other elements in the decision? Do you look at that in a wider sense or do you just keep to the pounds and pennies?

(*Mr Revolta*) If I may respond to that, I think the Treasury's principal interest in appraising a proposal which comes to us will be to judge it against the criteria I have mentioned, against affordability, i.e. public expenditure control issues, and also to assess value for money. But I think I can reassure you that it is in the nature of discussions with a

department on a project which is of that sort of size that in putting a case to us they will set out all the considerations which they think are relevant to it and clearly we must be aware of those to have a full understanding of the project and the case that is being made for it.

Lord Nelson of Stafford

53. Would you ever take a positive attitude on, for instance, Europe, which is one of your responsibilities? Would you ever take a positive attitude and say, "Why are we not taking more advantage of European-wide projects which are being supported by the French and Germans, and why are we not in them?" Would you ever take that view or would you say that has nothing to do with the Treasury?

(*Mr Revolta*) If I can speak first for the non-science side, I think it is unlikely that we would be putting that proposition to departments unless we had good general reasons to argue that overseas collaborations were going to be more advantageous than domestic collaborations. It is obviously the case that the economy of this country is in an international environment and new products and industries are increasingly internationalised, and departments as well as ourselves are very much aware of those considerations when we are looking to deliver their industrial or scientific objectives and our own wider economic objectives.

54. So for that reason you may take a more positive attitude on those things?

(*Mr Revolta*) Yes, I would say that is correct.

Lord Kirkwood

55. As more EC funding is directed towards basic research, do you see that the priorities in funding of basic science established through the ABRC and research councils in the UK will be squeezed in favour of the Commission's priorities under the framework programme?

(*Mr Mercer*) I think the answer to that really stems from something which I said earlier, During the negotiations on European Community Framework Programmes one of the United Kingdom's objectives, I think inevitably, is to try and ensure that the balance of research within those programmes accords as far as possible with our own domestic research priorities. Inevitably there will be shifts of balance over time within European Community research and it is the case that, so far as the recently agreed Programme is concerned, the 1990-94 Programme, there has been something of a shift in the balance of that Programme towards science. Although the Programme remains predominantly about industrial pre-competitive research there has been something of a shift towards science. That means in terms of our domestic arrangements that there has been something of a shift of responsibility towards the Department of Education and Science,

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again not a massive shift but a shift broadly reflecting the way in which the Programme itself has moved. That means again, other things being equal, that in terms of the adjustments to domestic programmes that are made as a result of that EC Programme, the Department of Education and Science will bear a slightly larger share than would otherwise have been the case. But the other important side of the equation is that because the balance of the Programme has shifted, we would expect there to be something like a corresponding shift in the balance of our receipts. That is to say, institutions engaged in the sort of research towards which the Programme itself has now shifted will benefit, and over time one would expect that benefit to be greater than any additional cost which the Department of Education and Science would have to bear from their own programme. So again, if you like, at that sort of micro level one would see the principle I tried to outline earlier, which is that there will always be a net increase in public expenditure and, therefore, a net increase in income of the research institutions concerned at both a micro and macro level.

Chairman

56. You quoted this figure of 30-35 per cent. Do you arrive at that by so designing the money that you put into the budget of the department concerned when it has attributed to it its share of the Framework Programme in order that something like 30-35 per cent. will appear in the end, or is it just purely fortuitous that it works out like that?

(*Mr Mercer*) No, it is not something that is done by design. It is something that occurs as a result of the scale of the programme itself and the way in which the controls operate. The 30-35p I have referred to before Sub-Committee B of the EEC Committee relates simply and solely to the 1990-94 Framework Programme and to the next seven or eight years, during which the bulk of expenditure under that Programme will take place and very broadly it is derived on the basis that our 20 per cent. public expenditure contribution to that Programme over seven to eight years will cost something like £750 million. The 20 per cent. of receipts which we expect the United Kingdom private sector to get will obviously also be about £750 million. We would expect with the application of current arrangements that the reductions, the adjustments in department programmes that would be made as a result of that increase in EC expenditure would be of the order of £500 million over the same period.

So there would be a net £250 million increase in public expenditure, a corresponding £250 million increase in the income of the research institutions and hence the 30 to 35 percent figure. It is simply £250 million by comparison with the £750 million of gross receipts.

57. Is this something the Commons Public Accounts Committee has looked into or not?

(*Mr Mercer*) I think I am right in saying they have not explicitly.

Chairman] Perhaps they should.

Lord Kirkwood

58. Given the fact that there will be a net increase in expenditure on basic science this will be in areas decided by the EC programmes and not by SERC and other research councils: is that true?

(*Mr Mercer*) They will be.

59. The priorities will be defined from Brussels and not by UK research councils?

(*Mr Mercer*) The priorities are defined in terms of the nature of the Framework Programme itself which in outline, although in relatively detailed outline, is subject to unanimity in Brussels and is, therefore, something over which Member States have considerable control. The United Kingdom itself consults all interested parties—research bodies, research councils—in order to establish our negotiating line. But, yes, I think it is fair to say that over time the priorities will come to reflect broad European priorities. It is part of our aim the United Kingdom's aim—to try to ensure those priorities are as close as possible to the United Kingdom's priorities and, therefore, that any adjustments that need to be made in United Kingdom domestic expenditure programmes correspond as closely as possible to areas which are beneficiaries from the European Community money, so that one does not get the marginal mismatch to which I referred earlier on.

Chairman

60. As to the whole situation about this European Programme which you have explained so clearly to us, do those who actually participate in it—you say 90 percent of them are private—understand as clearly as you have explained to us what the situation is about all these complicated matters?

(*Mr Mercer*) I would hope they do, and I equally hope that the extent to which private sector institutions do indeed go out and bid vigorously for Community money, as do public sector institutions—though on a rather smaller scale—demonstrates the fact that they are aware that at the end of the day, and in net terms when all the adjustments have been made, there is a large amount of additional purchasing power available to them by bidding for and securing Community money.

61. The research councils understand it clearly.

(*Mr Mercer*) I believe so.

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Lord Sherfield

62. Can I come back to the 35 percent? I see that it is a global figure and it is where the chips fall in the end that it comes out at something like a third, is that right?

(*Mr Mercer*) That is right in relation to the new Framework Programme. But there is an additional sum underlying that in the existing Programme.

63. This is solely related to the new framework programme and this is a sort of calculation of what will happen over the whole field but, of course, when you get down to individuals some get cut much more than 35 percent as it turns out. After the whole process has been gone through X project you suddenly find has been cut 70 percent or 90 percent. Others of course are not cut at all. So to that extent it is a sort of arbitrary figure, is it not?

(*Mr Mercer*) It is not entirely arbitrary. I do not dispute that the thought that underlies your question could indeed occur. If I could perhaps reiterate that the offsetting reductions are made in a department's own domestic expenditure programmes. They are not made directly in the budget of the research institution. Clearly some of those reductions would over time, through the way in which the department manages its own budget, filter through into the budgets of research institutions. But there will be cases, I think, undeniably where a department has to make a reduction and that reduction will not necessarily be offset or more than offset by an increase in receipts in the client bodies, in the research institutions for which that department has sponsorship responsibility. So in that sense, yes, the 30-35 percent is an average, but, again, the extent to which the average corresponds broadly to what

happens typically on the ground depends on how successful we have been in ensuring that our priorities and Community priorities are broadly aligned. I think, as I said, we have been broadly successful in doing that. There are cases where the shoe pinches. I think, to pick up a phrase David Revolta used earlier on, it is at that point where the system ceases to be mechanistic in the sense that we are tending to describe it—increases in receipts and offsetting reductions. It is at that point where negotiations in the annual survey process and all the rest of it take over.

Chairman

64. I understand the Commission is often a bit tardy in actually paying. Is there flexibility to carry on money from one year to another against the usual harsh Treasury rule that everything has to be finished off by 5th April?

(*Mr Mercer*) There is indeed a particular flexibility in the arrangements I have been describing whereby any necessary offsetting reductions in the departments' programmes are made some time after the European Community expenditure to which those reductions relate. For example, in the new Framework Programme European Community expenditure will start coming on-stream really from next year onwards. In the United Kingdom there will be no off-setting reductions in the departments' programmes associated with that expenditure till 1992-93. That sort of lag is built into the system.

Chairman] Time is passing. Thank you very much indeed for an extremely interesting and very helpful contribution to the start of our study. We now start from a sound financial base. Thank you very much indeed.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Thursday 12 July 1990

FOREIGN AND COMMONWEALTH OFFICE

Mr A R Brenton, Mr R J Northern and Mr D Turner

THE BRITISH COUNCIL

Sir Richard Francis, Dr John Richards, Dr June Rollinson and Dr Robin Sowden

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THURSDAY 12 JULY 1990

Present:

Adrian, L	Nicol, B
Carver, L (Chairman)	Shackleton, L
Kirkwood, L	Sherfield, L
Nelson of Stafford, L	

Examination of Witnesses

MR A R BRENTON, Head of Environment, Science and Energy Department, MR R J NORTHERN, Head of Science and Space Section, and MR D TURNER, ODA, Foreign and Commonwealth Office, called in and examined.

Chairman

65. Mr Brenton, we thank you and your colleagues for coming to help us this afternoon. Perhaps you would like to start by introducing your colleagues and making any form of opening statement you wish. I would be particularly interested in what part you see the Foreign and Commonwealth Office playing in this whole field, in particular whether you have any sorts of priorities about with whom scientists in this country should co-operate in international programmes. Do you put Europe first? Are there some priorities like that and, if so, do people know about them?

(*Mr Brenton*) To introduce my team, on my right is David Turner from the ODA who can speak on any question to do with money. On my left is Richard Northern, the great expert on this subject, to whom I will be turning regularly as the questioning proceeds. I do have a short opening statement which it might be helpful for me to make. First, the Foreign Office very much welcomes the opportunity to testify to this Committee and set out its role on international science and technology. As you have probably already heard, I have to say that the formulation of science and technology policy in Whitehall is very much a collaborative effort. A lot of different departments are involved: DTI, MAFF, DES and so on. In effect, we are not the lead department on any of the main projects. We are part of the team bringing an international perspective from a foreign policy point of view to what is very much a science-led operation rather than a foreign policy-led operation. In particular, on the diplomatic side we have no in-house scientific expertise of our own. The ODA obviously have a considerable body of expertise on which they can draw in connection with our dealings with developing countries in connection with our aid in the science and technology field. What we do have are a lot of embassies and a lot of contacts in science-producing and science-involved countries, and we see ourselves more in the role of facilitator and link-maker and transporter back to London of information, suggestions and ideas coming out of our embassies for possibilities of scientific and technological collaboration coming from overseas capitals and countries. As I said, government policy on international science collaboration is that we do it on scientific criteria. We do not believe in diplomatic science as such; we do not pursue scientific

collaboration for foreign policy reasons, although foreign policy is obviously relevant in the sense it offers a dimension. Foreign policy contacts can often benefit from scientific contacts, but the primary reason for going into any particular collaborative venture has to be scientifically justified. Consequently, foreign policy plays very much a secondary role. It follows that we do not lead on or provide funding for any major international scientific programmes. I think you will be having contacts later in your inquiry with the departments leading on the programmes and you can talk to them in more detail about those programmes. You asked whether we had any list of geographical priorities. The short answer to that is no, but through our embassies and contacts obviously there are countries on which we concentrate because they offer the greatest likelihood of being fertile ground for good science and good scientific collaboration. For example, we have science and technology sections in six countries, those countries being the ones we have judged likely to generate what we might describe as the most business in terms of international scientific and technological collaboration, and plainly those countries are concentrated in the developed world: for example, the big countries in Europe, the United States and Japan. As I say, they are the countries where the most advantageous forms of scientific and technological collaboration will come from. I should say there are minor exceptions to this rather backseat role. We do provide modest funds to the Royal Society for scientific exchanges with Hungary and the Soviet Union. We are responsible for the UK contribution—£3.2m in 1990—to the NATO science budget. There is a thing called an FCO Scholarship and Awards Scheme whose primary aim is to expose potential leaders and decision-makers of other countries to British values, but some of whose recipients tend to come from the scientific world, so in that sense FCO money goes into facilitating scientific contacts. Within the office I have three full-time people working on international science and technology collaboration carrying forward work of the nature I have just described. That is all I want to say by way of opening statement, and I am happy to answer any of the Committee's questions.

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66. Do you have a view about whether for foreign policy reasons you would encourage major international scientific programmes to be based in this country?

(Mr Brenton) There are arguments for and against basing big programmes in this country. Having them here can be a headache in some ways. You find there are problems about immunities, and so on; it can also be expensive. For instance, we pay £8m a year for the privilege of having JET here. On the other hand, there are also considerable arguments in favour of having them here.

67. Do you mean £8m across the exchanges?

(Mr Brenton) No. As host country we pay £8m, which is the money we pay up front in order to have JET here, and that is quite apart from our subscription. There are very strong arguments in favour of it. Having JET here enables young British scientists to go and see it very easily; there is a degree of prestige attached to having it established here. There is a spin-off for other aspects of British science. Therefore, I would not like to make a blanket statement as to whether or not it is desirable to have international scientific programmes here. The judgment depends very much on the particular details of the programme.

Lord Nelson of Stafford

68. To clarify two points, you refer all the time to science. Do you differentiate between science and technology, because many of the programmes are concerned with the transfer of technology—assistance in agriculture, assistance in productivity, assistance in industry and so forth. I am also wondering whether there may not be a change in emphasis with the changes in Eastern Europe. Is there any focus on special geographical areas particularly in the light of the changes in Eastern Europe?

(Mr Brenton) On the first point, no, we do not distinguish science and technology. We aid and facilitate and make contacts in respect of both things. The customers for the two tend to be slightly different. Technology tends to be led by companies.

69. You still do not take the initiative; the initiative comes from the provider of the science and technology?

(Mr Brenton) Yes. What I have said applies to both fields. Eastern Europe is rather a good example of an area where obviously the background and political circumstances have changed and that has a very direct effect on our willingness to explore particular opportunities for collaboration. Indeed, Whitehall is looking rather hard at the question of enhanced collaboration with Eastern Europe now, but what I have said stands. We have to judge any particular opportunity for collaboration on the basis of the scientific merits. The political background is

now vastly more favourable than it was two years ago, and that forms part of the final decision. The central focus of the final decision has to be the scientific or technological quality of the project under examination.

Lord Sherfield

70. You said you had scientific sections in six countries. I have got down Tokyo, Paris, Bonn, Moscow and Washington. What is the sixth one?

(Mr Brenton) Rome.

71. Are these scientific attaches?

(Mr Brenton) Their size varies from place to place. The tendency is to have a Counsellor heading a small unit with one or two first secretaries.

72. But there are some scientific attaches, or are they called scientific counsellors?

(Mr Brenton) They tend to be science and technology counsellors.

73. Do they report to the Foreign Office?

(Mr Brenton) They report to the whole of Whitehall.

74. They report to a committee which we are not supposed to know about?

(Mr Brenton) I might decline to answer that! I see a proportion of their correspondence; on the whole, I see most of it. On particular opportunities of interest to, say, MAFF, they will write directly to MAFF, and so on around the houses.

Chairman

75. Are they definitely charged with trying to encourage and foster participation in international programmes and general scientific co-operation?

(Mr Brenton) One of their chief functions is to keep their eyes open and establish a round of contacts which will enable them to spot opportunities and report them back to London. To give a particular example which happens to be in the top of my mind, I saw our Tokyo counsellor yesterday who described roughly the function which he performs. They arrange six or seven missions of very senior British industrialists in the course of each year and introduce them around. Each mission is devoted to a particular area of science and technology, like software development. They make a point of arranging programmes for them to speak to comparable people and experts in Japan in that area of technology, the aim being to establish a bridge between two obviously different cultures and to get people to meet each other—people who would not otherwise meet—allowing the experts to identify whether there are areas of work which can be mutually carried forward. They have produced a

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booklet which I have brought along today. That booklet describes particular areas of Japanese science and technology. Again, that is transmitted back to London and passed on to British industry. This facilitates the process of knowing what is going on in Japan and helps experts to identify whether or not there is scope for further action. If the Committee would find it help, we can leave this brochure with you.

Lord Sherfield

76. Following on from that, some of us here went on one of those missions looked after by the embassy in Tokyo about three years ago. We went to see a lot of people, and as a co-ordinated reply we were told that co-operation with the UK unfortunately was not very great because we did not have a bilateral agreement for scientific co-operation—the sort of blanket agreement they had with other countries. We did recommend in our report that we should consider having such an agreement in order to facilitate the sort of co-operation being talked about. Did this come about? Do we now have a bilateral agreement?

(*Mr Brenton*) I am afraid I do not know.

(*Mr Northern*) I am not aware of a government-to-government agreement. There are certainly agreements directly between the research councils and similar bodies.

That was not what we were talking about. There is still no inter-governmental agreement?

(*Mr Brenton*) I will take note of the point and check.¹

Lord Shackleton

78. I would have thought the role of scientific counsellors was not particularly oriented towards co-operating with or developing ISPs—whatever that means. Their role is essentially to provide information for British industry and the British Government, and some of them do it extremely well, and it would only be incidental if a programme came their way which they would recommend? Am I wrong about that? The Counsellors I have seen provide a mass of very useful information of help to industry and government, but I would not have thought that backing ISPs and looking after them would be a main activity. If it comes along naturally, they will promote it. Am I wrong?

(*Mr Brenton*) No. That is a proportion of their activities, but the information they supply generates opportunities.

Lord Shackleton] But not necessarily ISPs?

Lord Adrian

79. Before putting my question, I must declare an interest, since I am on the Board of Trustees of the Human Frontiers Science Programme which was proposed at an economic summit two or three years ago. I wonder whether you can describe to us the process by which that was assessed and agreed to in terms of the consultations which I take it you had because presumably you were the first to receive the suggestion that the Japanese put forward at Venice?

(*Mr Brenton*) I have to say that unfortunately I was not in the job at the time, nor was Richard.

(*Mr Northern*) I cannot help on the historical background. But it would have been reported back by our own embassy, and the Department of Education and Science would have taken the lead at this end in consultation with ourselves and the Cabinet Office.

Chairman

80. Following up that point, these international scientific programmes are initiated in all sorts of different ways. Some start from the top, like EUREKA; somebody says, "We ought to have something like this. What will we do?" Some of them bubble up from the bottom where scientists working in the same field come to the conclusion that there ought to be a programme where there has not been one before, like EMBL. When would the Foreign Office expect to get involved in either giving advice as to whether there was some foreign policy aspect to it or get involved in any of the negotiations themselves? To take an instance, I believe there are two rival projects for a major optical astronomical telescope, one involving the United States and Canada and the other involving Spain in the Canary Islands. Where and at what time would the Foreign Office come into this? Would you have a Foreign Office view as to which of the two, if the scientific arguments were exactly the same, would be preferable?

(*Mr Brenton*) To answer the first half of the question about how the idea gets back to London, it will go into the machinery, which one of your colleagues has said I am not allowed to describe to you. We are full participants in that machinery, and we will therefore play a full part in the discussion. From the moment it becomes common Whitehall property we are in there and our arguments are heard.

81. Does that machinery work well?

(*Mr Brenton*) It is like any bureaucratic machinery; it has its virtues and vices. Speaking personally, bureaucratic machinery on the whole produces rather safe decisions. With regard to the question of having two alternatives where the scientific arguments are finely balance, speaking personally I think we in the Foreign Office would not

¹Note by the witness: The UK has no government to government agreement with Japan on science and technology. But this does not currently provide any obstacle to practical cooperation with Japanese companies or institutions. We hold informal talks periodically with Japan at official level to review bilateral cooperation in science technology.

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feel capable of making a judgment; it would be a matter for the experts themselves. What we can do is say that there are foreign policy advantages in going down *this* route, and if the experts do not judge that the science points firmly in one way or the other—and the example of the telescope is one to be taken up by the Science and Engineering Research Council very soon—we are there to help; we have an assessor on the Council, and we make that input into the discussion as it takes place. On that particular issue, we have been party throughout all the discussions leading to the decision.

82. You would not say as a matter of principle that one should co-operate within Europe first before thinking of co-operating with somebody outside?

(Mr Brenton) No.

Lord Nelson of Stafford

83. Does the Foreign Office ever take the initiative? For instance, if we have an international collaborative effort it has been said often that we do not make as much use of it as we might in terms of exchanging young scientists. Do you ever monitor them and yourself take the initiative and say, "You have got this interchange, but you are not taking as much advantage of it as you could. You could be sending people over here to get information from wherever on an exchange basis"?

(Mr Brenton) No. It is not for us physically to arrange for the exchange of scientists.

84. Who is to do it?

(Mr Brenton) Various other government departments do it, and universities and other bodies, including the British Council, provide scholarships.

Lord Nelson of Stafford] We are having difficulty identifying that particular body; it always seems to be somebody else's job.

Lord Shackleton

85. Would it be a reasonable observation to make that in the matter generally of ISPs the Foreign and Commonwealth Office do not play a major role? This is no reflection on what you are doing; you are doing a lot of things. Would that be an unreasonable assumption, or would you like to qualify it?

(Mr Brenton) No; I think that is fair. We do not lead; we are a source of advice.

Baroness Nicol

86. You said you never took the initiative on ISPs, but do you ever veto them for diplomatic reasons?

(Mr Brenton) I think "veto" is a slightly strong word. One can conceive of cases where for political

reasons we would want to downgrade relations with a particular country and where science exchanges might be swept up in the downgrading.

87. So, the science would not weigh in that case; the diplomatic reasons would come first?

(Mr Brenton) The example I can think of is a case where science is on an upward gradient in a sense and as a result of political developments in the country I am thinking of that gradient has flattened off. It may have done so anyway. The political developments in that country resulted in really a voluntary cut-back in contacts, but the political cooling contributed to that process.

Chairman

88. You would not take a Foreign Office view and say you think the initiative ought to be taken now to improve scientific co-operation or to improve participation in international programmes with the Soviet Union, for example?

(Mr Brenton) With regard to Eastern Europe and the Soviet Union, the Foreign Office view is that lots of restraints which used to operate, including institutional ones like COCOM, have been weakened or have disappeared so that doors are now open. We are no longer keeping locked doors which used to be closed. It is then for the scientists and for the Whitehall machinery to identify real scientifically advantageous and technologically advantageous areas for co-operation. Certainly, the change in political climate has changed the scope, and we have made that clear in our contribution to the debate on the subject in Whitehall.

89. But you are not positively encouraging it?

(Mr Brenton) In those terms, no. As I say, it is a matter of whether or not it is the right science.

Lord Shackleton

90. Would it not be fair to say that with regard to Eastern Europe—and I have been much involved as Chairman of the European Trade Council—long before *perestroika* there were a number of co-operative activities which the Foreign Office would have wanted to keep an eye on, some of which worked rather well, unless money was involved, in which case almost on principle the British Government would say "no"? You would be consulted, would you not?

(Mr Brenton) Yes.

91. You would express an opinion, would you not?

(Mr Brenton) Yes.

All sorts of conferences have been going on for years?

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(*Mr Brenton*) Yes, we would express an opinion, and the opinion would be, "If you think there are advantages in going ahead with this, then we certainly see no political impediment; indeed, we see political advantage in it. We are thickening our relations with these countries; they are coming our way, and the more links we can establish with them the better."

Chairman

93. To get back to Europe, do you take a view about whether it is a good thing to encourage European scientific subjects on a much wider basis than the Community, or to put effort into improving the science activity of the European Community, because there are all sorts of projects and programmes which are outside the Community and which involve Community Members? It seems to me there is a struggle going on between the Community trying to build up its scientific activity and building up a that European science activity on a wider basis. Is there a Foreign Office view about this? Do you encourage people to do it?

(*Mr Brenton*) I am not sure I would describe it as a struggle. The Community has a rather clear set of programmes and they are programmes of the sort best pursued by means of the Community budget. We firmly support that; we are committed to the programmes and to the budget. We would not wish that sort of institutional activity to preclude more *ad hoc* bilateral activity where other groupings may be more appropriate. It seems to me that the two go hand in hand. I would not say that one has particular priority or advantage; a different sort of programme may be good for different things.

94. But do you support the view put forward by a lot of people that it is important European science and technology should be built up in competition with American and Japanese programmes, because that is behind a lot of thought? It is said that Europe ought to have a science base which competes and does not collaborate so much with the Japanese and Americans, or that it can collaborate only on an equal level if it is built up into a European base rather than a series of national bases?

(*Mr Brenton*) I do not believe that. I was once a research scientist; I was a mathematician in a small way. The very firm impression I got as to the way in which science progressed was by co-operation amongst the people best placed to co-operate, whether they be American, Japanese or European. I would not want to focus British science exclusively on a European option. It seems to me that the right people for us to collaborate with are the best potential collaborators, wherever they come from, so there is no prejudice in favour of Europe rather than the States, for example.

95. What do you see as being the obstacles within this country in taking part in international

scientific programmes or obstacles which are erected outside this country in taking part in such programmes? Are there any such obstacles? Are there any particular problems other than just the general problems of international co-operation?

(*Mr Brenton*) If you mean problems peculiar to the UK, I am not conscious of any. That sounds like a bit of a whitewash. It is fair to say we do take a much more precise look at the financial and scientific benefits as balanced against each other of some international collaborative projects than some other major scientific players do. Therefore, we can occasionally look as if we are more concerned with saving money than advancing international science. Obviously, I am a defender of the British approach; I am spokesman for that approach, and I know that the way these projects are looked at is one in which a careful balance is struck between the advantages of spending the money on an international act of collaboration *vis-a-vis* spending the money on more nationally-based science. Again, it seems to be the right comparison to make. Against that background, we believe we get the best deal we can.

96. Turning to one of the obstacles perceived from outside to getting this country to participate in science, the International Council of Scientific Unions said in evidence to us that they found it much easier to deal with countries which had ministries for science than to deal with us; in our case they found it all so split up. If somebody wants us to participate, starting at a low level who first receives the request? Do you get it?

(*Mr Brenton*) As I have said, the request can come through various ways. All serious requests end up in the same machinery. I am not sure that the lack of any ministry of science is actually a big disadvantage. Different countries have arrangements which correspond to their own institutions and their own funding arrangements, and there is no common pattern amongst our partners. In a sense, we do have a centre in the form of the Chief Scientific Adviser and the Cabinet Office. I do not see that we suffer any disadvantage in that way.

Lord Nelson of Stafford

97. To what extent do you see the technical aid programmes of the ODA as being part of the international scientific programmes, or do you see them purely as bilateral arrangements?

(*Mr Turner*) In a sense, I think our aid effort is a collaborative venture with developing countries.

98. On a bilateral basis?

(*Mr Turner*) Yes, and part of the aid programme is contributed through multilateral agencies, such as the World Bank. But it is a collaborative venture, and as is clear from your Lordships' inquiry in the 1989-90 Session on UK aid in relation to science and technology to help developing countries, science and

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technology pervades most of our aid activity in one form or another, so in that sense one can see it as a collaborative scientific programme.

99. Do you think it will become more so with growing interest in things like the environment, global warming and CO₂ emissions?

(*Mr Turner*) Yes. We are already seeing increased activity within the aid programme on environmental concerns, and that includes much increased work on tropical forest. We are looking at initiatives on biodiversity, and we are seeking to strengthen our activities in help on energy efficiency programmes, so there is increasing emphasis on this.

100. Do you think there is a need for developing machinery for that, for instance the World Bank or some other co-ordinating medium, to pull it all together, as distinct from just one country doing it with another country? Is it not too big for that?

(*Mr Turner*) I think there does need to be international co-operation and co-ordination of these global environmental issues. As far as the aid element is concerned, at the moment we are looking at a proposition which the World Bank is developing to come up with proposals to co-ordinate multilateral activity in relation to global environmental issues.

Chairman

101. On pages 4 and 5 of your written evidence you have given us a long list of international institutes. You say they are provided through the Consultative Group on International Agricultural Research, but how are they set up and managed? They are not FAO institutes or UN institutes, are they?

(*Mr Turner*) No. The institutes to which you refer set out in the memorandum provided are international agricultural research centres, of which there are 13. They are brought together under what is known as the Consultative Group on International Agricultural Research—CGIAR—which was established in 1971. That is an informal association of over 40 countries, international and regional organisations and private foundations. The CGIAR meets twice a year and reviews the progress and reports of each centre and collectively come to an assessment on continued support and the direction for those centres.

102. You provide the British financial contribution?

(*Mr Turner*) The ODA provides the financial contribution.

103. Not MAFF?

(*Mr Turner*) No.

Lord Shackleton

104. We did cover a great deal of this in our report on the ODA, and I find it rather difficult to deal with the ODA along with the Foreign Office. It was merely as a result of a change in government that you became part of the Foreign Office, whereas under the Labour Government you were a separate Ministry. I am not quite clear whether the Foreign Office, other than the general advice they give, have much of a role with regard to the ODA. Obviously, the ODA is much involved in international agreements, though they express views that a bilateral is sometimes preferable. It would be fair to say that the ODA really goes ahead on its own. The Foreign Office has an input, as it does in other cases. Its Minister comes under the Foreign Secretary, but the ODA is really run as a separate department. You have your own permanent secretary and your own Minister. Perhaps you do not want to comment on it. I think we produced a pretty favourable report on the work of the ODA. I do not say that the Foreign Office do not deserve some credit; perhaps their credit is that they have not spoiled the work of the ODA.

(*Mr Turner*) My Lord Chairman, the position is that the Foreign Office comprises the diplomatic wing and aid wing, which is also known as the ODA. We have the same Secretary of State. The ODA does have its own Minister and permanent secretary. What happens in practice on these other issues is that both wings work together. For example, on the environmental issues raised earlier, we are very much working together, because Mr Brenton's department is very much concerned with international (collaborative venture) negotiations, and we in the ODA are dealing mainly with technical advice on such questions for example, relating to forestry, particularly as they impinge on developing countries. It is very much a joint effort.

Chairman

105. But it is none of ODA's business to look around and see in what ways British science can be helped by these sorts of participations; it is British science helping other people?

(*Mr Turner*) Yes.

106. Lord Shackleton has referred to our earlier report on the ODA. What is relevant to a lot of the evidence we have received today both from you and the British Council is that it appears the relationship is very close and it is not always entirely clear what is the British Council's responsibility and what is the ODA's responsibility. In recommendation 50 of that report it was said that the relationship worked fairly well in practice, but because of the scope for confusion and duplication the Committee recommended that the FCO should more carefully define areas of responsibility without sacrificing the flexibility which currently existed. I took a look at

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the Government's response to that report and I did not see any reference to that. Would you like to make any comment on that?

(*Mr Brenton*) Again, that recommendation is new to me. The differing areas are fairly clearly defined. As Mr Turner has said, on aid matters—therefore, helping the science of developing countries—the ODA is very much in the lead, and on the whole the diplomatic wing contribution is very minor. On large multilateral issues where one is engaged in political negotiation with an aid aspect, the diplomatic wing is heavily involved as well. If I may say so, I think it would be a mistake to try to tie down roles more tightly than that.

107. I was referring to the different responsibilities between the ODA and British Council. Since the Committee's report was published, have the FCO looked at this and decided it was not necessary to do anything about it, or have they done something about it?

(*Mr Turner*) I do not think I am in a position to answer your question in detail. What I am aware of is that, together with the British Council, the ODA are constantly looking at our respective roles and defining them. The British Council acts for the ODA: for example, in relation to scholarship programmes, particularly in relation to education and training projects overseas. In such cases the Council will act as managers of those projects on behalf of the ODA. There is a continuous process of assessment of our respective roles and whether they are correct.

108. Would you care to comment on how other countries handle the political aspects of scientific co-operation and participation in these programmes? One certainly has the impression that the French regard it as part of their foreign policy to host a major scientific project and participate in it in addition to just the contribution they make to building up good French science. Do you get the impression that other countries do this, or do other countries take what I might call the rather pure scientific view you take that it is entirely a scientific matter and you are not trying to plug British science?

(*Mr Brenton*) Obviously, different countries have different approaches, and the French approach is very different from ours. They attach higher value to having major international programmes on their soil. No doubt, they have their own reasons for that approach. I think the French are at one extreme and we are at the other. I am not conscious that anyone else takes such an intense approach as they do. All I can say is that there are differences, and we think our approach is the one best suited to our interests.

109. Would you admit that these days, when facilities for research are very expensive, there is an interest in having major facilities based in this country in order that we can play an effective part in

international co-operation, so that when we do so we have the requisite number and quality of scientists, which we would not have if we were not able to attract them to research in this country by having the facilities in this country?

(*Mr Brenton*) As I have said, I think the balance of the argument varies from project to project. In the case of one very major project, JET—Joint European Torus—we judged there were sufficient advantages in having it here, and we went to considerable lengths and succeeded in getting it established here. In other cases, we have made the reverse judgment. I would not want to imply there is a general rule.

Lord Sherfield

110. Following that, we have received evidence already from EMBL. I would like to draw attention to what they say and then make two points. They say: "To judge from the benefits gained by Germany by hosting EMBL, my advice to any country in Europe would be to try to attract international laboratories to its territory." There is another rather technical point. There is also a reference to UNESCO in the evidence we have received from the ICSU. The question I ask is: Are we collaborating with any UNESCO projects at this point, or have we withdrawn from it all?

(*Mr Brenton*) Yes, we are. I do not know the position in regard to scientific projects, but we are still a party to Man and the Biosphere.

111. That is an international biological programme?

(*Mr Brenton*) Yes. There are other bits of UNESCO in which we are involved.

112. But you are still working with UNESCO?

(*Mr Brenton*) Yes, with particular specialised bits of it, though of course we are not members of UNESCO.

Lord Kirkwood

113. I would like to return to the obstacles to the setting up of effective ISPs. Is there any evidence that UK research staff are less well paid and are given less budget facilities than those available to our overseas partners in ISPs, and do you think that, if true, it could have a harmful effect in creating effective ISPs?

(*Mr Brenton*) I do not think that conditions of pay and conditions of research for UK staff is really an issue for the FCO to comment; it seems to me that is more a matter for the department funding the project.

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MR A R BRENTON, MR R J NORTHERN
and MR D TURNER

[Continued

Lord Sherfield

114. EMBL refers to the adverse consequences of the British Nationality Act for UK staff at EMBL, because some of their children do not have the right to full British citizenship. Do you say that is a matter for the Home Office?

(*Mr Brenton*) No; it reflects a little bit on this question. I think the relevance of the British Nationality Act is a bit difficult to discern, because the child of a British national, except in very special circumstances, himself or herself inherits British nationality.

Lord Adrian

115. But their children do not?

(*Mr Brenton*) There is a danger that their children will not. The trick is to come back to England to have the baby, which is not all that difficult nowadays. Our impression is that British scientists are extremely mobile and are well accepted in these projects. I would not want to make a hard and fast statement, but certainly the impression is that if there are constraints on the movement of British scientists they are not very strong.

116. Earlier you said you looked at each ISP on its merits in terms of whether or not to make a bid to have its headquarters in the UK, and on balance you would decide to have it here if you thought it to be in the national interest. In general, what criteria do you use to judge that interest? Is it primarily financial, which was the impression I gained earlier, or do you try to set out the advantages, which are difficult to measure but nowadays we are told all the time we have to measure? Do you attempt to balance those non-quantifiable advantages, as it were,

against the financial aspect? It seemed to me that you were rather heavily weighted in terms of the financial costs?

(*Mr Brenton*) I have to say that I have never been party to one of these decisions, but my impression is that one strikes a balance. The financial element is there, and that has the advantage of being quantifiable. Arguably, there is excessive weight in the assessment of the financial commitment.

Chairman

117. Is the Foreign Office involved in the argument about whether or not the environmental programme should be in Cambridge?

(*Mr Brenton*) Yes.

118. Which side are you taking?

(*Mr Brenton*) I decline to answer that question!

Baroness Nicol

119. In what terms does the FCO see the success of the ISPs? Is it looked at purely in financial terms?

(*Mr Brenton*) No. There are criteria, which are not Foreign Office criteria but Whitehall criteria, against which to measure the success of ISPs, and they include all the non-quantifiable factors—the products of the science, the spin-offs, institutional and personnel matters. It is against those criteria that Whitehall, and obviously the Foreign Office, will judge the success of any project.

Chairman] *Mr Brenton*, thank you very much indeed. What you have said has been very helpful. I am not sure we understand much better than we did before what the machinery is for dealing with these things, but we are grateful for your assistance.

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[Continued

Memorandum by the British Council
BRITISH COUNCIL ACTIVITY IN SCIENCE AND TECHNOLOGY:
INTERCHANGE OF PERSONS

1. INTRODUCTION

1.1 This memorandum is submitted by the British Council as written evidence to the House of Lords' Select Committee on Science and Technology for consideration in its study of the United Kingdom's response to proposals for international scientific programmes. The Committee has expressed a particular interest in the exchange of persons and information and this will be the main focus of the memorandum.

1.2 There follows a description of the British Council's objectives, funding and its work in strengthening the UK's bilateral relations in science and technology (section 2), a description of its programmes for the interchange of persons in science and technology (section 3), the project work it undertakes (section 4), the information services it uses to support its objectives (section 5), examples of country science and technology programmes (section 6) and a discussion of the particular issues raised by the Committee (section 7).

2. THE OVERALL CONTEXT

2.1 The British Council

2.1.1 The British Council is Britain's principal agency for the conduct of cultural relations overseas. It is an independent and non-political organisation managed by a Director-General working to a Board. Its aim is to promote an enduring understanding and appreciation of Britain in other countries. It does this by providing access to British thought, experience, achievement and expertise across the cultural spectrum, but notably in education, the arts, science, and other fields important in technical co-operation.

2.1.2 The British Council's *global budget* of £348 million (1990-91) can be divided into two components:

- Funding for British Council programmes amounting to some 51 per cent of total budget derived from *government grants* (35 per cent) comprising various grants-in-aid from the Foreign and Commonwealth Office (FCO) and the Overseas Development Administration (ODA) and *revenue* (16 per cent) representing all the earnings made by the Council for the direct provision of services.
- *Agency funding* refers to money received largely from the (ODA) (36 per cent) and FCO (6 per cent) to support programmes handled by the Council on their behalf. Some agency funds (7 per cent), including sponsorship, are received from a range of other bodies.

2.1.3 The British Council is represented overseas by 145 offices in 90 countries, each of which offers a point of access for all aspects of British culture, science and education. They are complemented at home by a nationwide network of offices in close contact with government, academic institutions, the professions and business.

2.1.4 The British Council's work falls into five main activities:

- the interchange of persons, helping those from overseas to study, train or interact with professionals in Britain, and enabling British specialists to teach, advise or establish joint projects with counterparts abroad.
- the promotion of British education, science and technology.
- the teaching of English and promotion of its use.
- the provision overseas of information services and British libraries.
- making British arts and literature more widely known and appreciated abroad.

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2.2 *The Work in Science, Technology and Medicine*

2.2.1 The contributions of British scientists, agriculturalists and engineers to the world's stock of scientific knowledge is widely appreciated in developed and developing countries alike. The British Council's aim in its work in science and technology (S&T) is to maintain and develop this appreciation by providing access to the best of British science and research. The Council's principal means of achieving this is through the interchange of persons, provision of information services, and through the management of projects in S&T on behalf of the ODA and other sponsors such as the multilateral donor agencies (e.g., World Bank, European Commission). As the Council's focus is predominantly outward, the needs, demands and opportunities of the overseas country concerned largely determine the priorities for the Council's work in S&T in that country. In developing and aid countries much of the work is conducted on an agency basis on behalf of the ODA or the host Government who remain responsible for policy. In such countries the Council uses its government grant to fund activity in S&T that is complementary to this work.

2.2.2 There is therefore a distinction between the Council's aims and those of the other UK agencies engaged in promoting international exchange and collaboration in S&T where the interest is in strengthening UK research and securing access for British scientists to scientific knowledge and facilities overseas. The bulk of the Council's work in S&T takes place in the bilateral context. The associated interchanges of scientists and provision of information on UK attitudes, structures and resources reinforce this.

2.2.3 The British Council does not normally engage directly in sponsoring research either in Britain or overseas, except where this satisfies a training objective such as a scholarship or technical co-operation training award. Since the Council focus is predominantly bilateral and it does not fund R&D in its own right, it is generally not appropriate for it to participate in large scale, multilateral international science programmes (ISP). Similarly, it does not use its scientific interchanges of persons schemes to support such programmes. Exceptions might exist if alternative sources of funding were not available and the visit supported other Council priorities, perhaps peripheral to the ISP, such as broadening bilateral contacts or ensuring senior British representation at key meetings overseas. The Council does, however, seek to develop research collaboration and contacts between scientists overseas and in Britain, but the collaborators are expected to have secured the necessary research funding from other sources. Such funds are made available by the national bodies responsible for funding research and therefore the Council supports collaboration that is complementary and mutually beneficial. This often involves working alongside the UK Research Councils and higher education institutes to promote bilateral S&T relationships. Contacts and linkages enjoying such patronage are more likely to enjoy continuity of research support and to grow.

2.2.4 In its support for S&T relations with countries of the developed world, the British Council is increasingly entering into jointly funded programmes of collaboration such as the joint research schemes now operating in many Western European countries. In some countries such as Spain and the Netherlands, the British Research Councils jointly support programmes of collaboration with the Council. In others, e.g., Japan, the British Council has supported the development and activity of collaborative programmes sponsored by the Research Councils. Close relations between the British Council and the Research Councils and The Royal Society have evolved over the years, and there is good complementarity between the schemes and services they each offer for international exchange.

2.2.5 Where appropriate the British Council also supports S&T relationships led for the UK by Government Departments. These relations are frequently covered by inter-agency agreements and regular talks. Examples exist in Poland where the British Council assists in S&T programmes between the UK Department of Trade and Industry, the UK Department of Health and their Polish counterparts. Local British Council staff often contribute informally to UK discussions on other bilateral and multilateral S&T co-operation overseas, e.g., EUREKA. This is particularly so where the British Council has the only science-qualified British staff deployed locally.

2.2.6 The British Council's support for bilateral research and institutional collaboration is generally available during the early years of a relationship, typically three years. Thereafter, it expects successful collaborations and relationships to be self-sustaining. Within the European Community, links of one description or another have frequently attracted Commission funding under the European programmes for R&D, e.g. the Framework Programme. Indeed, with its network of offices in Europe, the British Council is uniquely placed to play the role of broker in identifying partners for UK researchers and institutions. The influence of Community policies for cohesion will increasingly draw the scientists of the smaller European economies into European research programmes providing further opportunities for British Council offices in Europe to contribute.

2.2.7 The British Council has also initiated scientific contacts and then supported the early stages of collaborations supported subsequently by the Research Councils. The Science and Engineering Research Council's relations with the Japanese Ministry of Education, Science and Culture and other research bodies is an example where this approach has been particularly fruitful, and has led to substantial Anglo-Japanese research projects and Japanese participation in major British research facilities.

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2.2.8 The existence of European Community S&T programmes with non-member states is providing opportunities for the British Council in those countries to work alongside the local Community delegation to encourage Community-funded collaboration with British researchers. This approach is most developed in Yugoslavia. Further opportunities can be expected to grow in future years, particularly in Eastern Europe and the developing world.

2.3 The Geographical Context

2.3.1 The priorities and policies for the part of the British council's S&T work that is funded from its government grant in a particular country are largely determined by the Council staff in that country. Therefore the pattern of work results from their contacts with local specialists and institutions and is coloured by the advice they receive on UK resources from Britain. However, there are broad similarities in the patterns of S&T work in the industrial countries where the emphasis is on interchanges of persons and developing mutually beneficial collaboration. British Council funded contacts in S&T are typically in academic or fundamental areas of research and seek to promote an understanding and appreciation of British science. There is an emphasis on developing longer term bilateral collaboration wherever possible. Increasingly, these programmes of exchange and collaboration are run and funded jointly with counterpart agencies overseas. This has the dual benefit of doubling the extent of activity achievable from a given level of Council funding and ensures that agreed activity is both excellent and mutually beneficial. The Council also funds the exploratory exchanges which are a necessary precursor to successful collaboration, as well as one-off visits and scholarships to promote knowledge and experience of British science.

2.3.2 The British Council's work in Eastern Europe has largely been constrained within bilateral cultural exchange programmes (CXPs) and other exchanges of scientists that have been specified in advance. With liberalisation and political changes have come opportunities for more meaningful collaboration in S&T outside the CXPs. In Hungary, the British Council launched in 1987 a small programme to support the UK travel and subsistence costs of co-operation between research groups in British universities and the Hungarian Academy of Sciences. The costs in Hungary are met by the Hungarian authorities while the costs in Britain are drawn from the Council's government grant and the FCO Scholarships and Award Scheme. The British Council's pattern of scientific exchange with Eastern Europe in the future is expected to resemble increasingly its programmes in Western Europe. Currently, little is known in the West of the science in Eastern Europe and an increased number of exploratory visits will be necessary in both directions before programmes of co-operation can be established with confidence. Under the Known How Fund, the British Government's assistance to selected countries of Central Europe, British Council initiated programmes have been "agreed" in agriculture and medicine in Poland and in the environment in Czechoslovakia. Other S&T related programmes are under consideration. Increased support for scholarships and links will also emerge.

2.3.3 In the developing countries, the British Council's funds available from its government grant are modest and are concentrated on pump-priming activities and supporting co-operation not covered by the UK aid programme. Wherever possible the Council seeks to co-fund these activities with the host countries. These funds are used to complement activities sponsored by the ODA and other donors.

2.3.4 The establishment of longer term relations is seen as an important objective and the British Council operates, with a special grant from the ODA, a range of institutional links between UK higher education institutions and similar bodies in developing countries, the great majority of which are in science and technology. These links have an important institution building role and can be expanded into major aid projects if warranted.

2.3.5 Much of the Council's S&T work in developing countries is carried out directly on behalf of the ODA and according to the Government's policies and objectives. The Council is therefore the implementing agent for a range of schemes and programmes which support S&T activities and interchange. The major programmes are:

- Technical Co-operation Training Programme
- Commonwealth Scholarship and Fellowship Programme
- Projects in Science & Technology

The ODA is in the process of converting many rolling programmes of manpower development assistance into more focussed and time-bound projects and the British Council is undertaking matching adjustments to its own structure and working methods.

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2.4 The British Council's Structure and Specialist Support

2.4.1 The British Council's network of offices overseas has developed over the years to provide the main policy and delivery point for British cultural relations overseas. The network also acts on behalf of other bodies to deliver services in education and science. London-appointed and locally engaged staff in these offices are expected to develop activities which match local opportunities and thereby maintain close contacts with the officials and professionals of host governments. In countries receiving British technical co-operation, the British Council proffers advice to the ODA on local conditions to augment their policy making and administers appropriate technical co-operation programmes and projects, often in S&T.

2.4.2 In many of the posts with major collaborative or aid programmes in S&T the council maintains science-qualified London-appointed staff (Annex 1). These are often supported by qualified and experienced local staff. In London the British Council has sixteen specialist S&T advisers whose job is to provide advice and access to resources in science, technology, agriculture and medicine for their colleagues overseas and the operational departments of the Council. They are supported by four specialist committees with members drawn from amongst the senior figures of the British scientific community who provide a key advisory role to the Council's work in S&T.

3. THE INTERCHANGE OF PERSONS PROGRAMME IN SCIENCE AND TECHNOLOGY

3.1 The British Council operates a number of interchange schemes on its own behalf and as an agent for others, principally the ODA and FCO. The Council provides the management and administration of agency schemes, but the policy direction is retained by the sponsor.

3.2 The principal British Council-funded schemes for inward exchanges are the *Visitors and Fellowship Schemes*. However, British Council staff overseas provide increasing numbers of grants-in-aid and part-funding for specialists visiting institutions in Britain. The application of these schemes to interchanges in S&T is very flexible and can support a variety of programmes to support existing collaboration or explore new possibilities. For example, in France the British Council provides grants to support engineering research attachments at universities in Britain for staff and students of the prestigious Grandes Ecoles. Globally, the Council funded 689 fellowships in S&T, generally of durations ranging from 2 to 12 months and 935 visitorships in S&T to Britain during 1989-90 (Annexes 2, 3 and 4).

3.3 The British Council also makes arrangements for visits by appropriate British scientists undertaking short professional assignments overseas. Such visits, when funded from the government grant, can be fully or partly funded *Specialist Tours* or *Travel Grants* administered by the Council in Britain (Annex 5) or awards made directly to specialists by the appropriate Council office overseas. These outward exchange schemes are widely used to meet specific requests from overseas for eminent British scientists to contribute to courses or professional meetings, to provide specialist advice, as part of programmes of research collaboration or to investigate opportunities for joint work. These awards can form parts of more formal programmes as in Italy where, in addition to supporting ad hoc requests for travel grants, the Council operates a joint programme of planned exchanges with the Italian National Research Council (CNR) to develop Anglo/Italian co-operation and contacts in the sciences.

3.4 In recent years the British Council has initiated a series of jointly funded and administered programmes to support *science research collaborations*. Major programmes exist in Spain (Acciones Integradas), the Federal Republic of Germany (Academic Research Collaboration—ARC) and France (Alliance), with smaller programmes in Portugal. However, similar programmes are being created during 1990-91 with other European countries, e.g., Italy, Sweden, the Netherlands, Switzerland. The Acciones Integradas scheme has been running in Spain since 1983, and currently operates with matching funding of £210,00 from both the Ministry of Education and the British Council. The Science and Engineering Research Council contributes additional funds. In 1990-91 the programme will support 126 research collaborations between British and Spanish research groups, covering travel and other expenses associated with the collaboration. In all countries, joint research meetings and exploratory visits help to identify opportunities for collaboration. For example, in 1990-91 Anglo/Spanish meetings are planned in yeast molecular biology, atmospheric pollution and magnetic materials.

3.5 The British Council also organises a number of short *Specialist Courses* and seminars in Britain for senior scientists and other professionals drawn from overseas. The faculty for these courses is provided by leading UK specialists. Courses in medicine have been particularly successful and are often repeated on a regular basis. These courses are largely self-financing and are therefore a particularly cost-effective way of promoting British expertise in the sciences and medicine overseas. In 1989-90 the Council ran 26 courses in S&T (Annex 6).

3.6 The Council administers on behalf of the FCO the *Foreign and Commonwealth Office Scholarships and Awards Scheme* (FCOSAS) which provides for a variety of inward visits, many of which fall in the sciences, of durations up to 12 months. In 1989-90 the FCOSAS supported the visits of 925 scientists to Britain (Annex 2). The aim of the programme is to support Britain's diplomatic, cultural, developmental, business and trade related objectives.

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3.7 *The Commonwealth Scholarship and Fellowship Plan* is a British Council administered programme designed to encourage academic studies in Britain by Commonwealth citizens and is funded jointly by the FCO and the ODA. Some 890 awards were made in science subjects during 1989-90 (Annex 2).

3.8 The British Council also undertakes a range of contracts on behalf of overseas governments, international agencies, the European Commission and United Nations to provide training including scientific and technological subjects. During 1989-90 the Council arranged S&T training in Britain for a total of 2,507 trainees. The contracts included postgraduate and research training elements (Annex 2).

3.9 However, the largest of the schemes for inward visits administered by the British Council is the *Technical Co-operation Training Programme* (TCTP) which is funded by the ODA to promote the transfer of skills and know how for the social and economic development of aid-recipient countries. Research training placements arranged by the Council in S&T under this programme during 1989-90 amounted to 6,119 (Annex 7). The ODA increasingly links TCTP training awards to its Technical Co-operation projects and therefore these awards include those associated with higher education links, institution building and research projects.

3.10 The British Council administers an *academic links programme* that is funded from a block grant from the ODA (£2.37 million for 1990-92) and its own government grant (£160,000). This supports nearly 600 links in over 50 countries, primarily aid recipients, and some 80 per cent are in S&T. The overriding aim of the programme is to develop overseas institutions of higher education, training and research. This is achieved through a transfer of skills and experience between institutions in Britain and overseas, which takes place through interchanges of staff in both directions, staff and curriculum development and joint research in S&T. The bulk of the links are concentrated in sectors of high aid priority, where a contribution is expected to national economic and social development. Account is therefore taken of ODA country policies when British Council staff overseas investigate and propose links. The small number of links funded solely from the Council's government grant do not need to meet these criteria. The Council's work in this area is guided by the Committee for International Co-operation in Higher Education (CICHE). Members of CICHE are senior representatives of British higher education institutions (HEIs) and others.

3.11 The enthusiastic involvement and support of the HEIs, made available through CICHE, make the programme a good value for money means of delivering British expertise overseas. Overseas institutions are often in a position to provide some or all of the in-country costs of co-operation, which extends the purchasing power of the ODA grant.

3.12 In many cases links lead to, or form part of, larger scale development or research based projects, which attract funding from ODA, the multilateral donor agencies or other sources. An example is the link between the Khon Kaen University in Thailand and Newcastle University which conducted joint research on the possible ways of improving the properties of fragile soils in North-East Thailand. This had led on to a project to improve the agricultural productivity of upland sandy soils in the region, funded by the European Commission to a total value of 420,000 ECU. Some research links have led to commercial uptake of the work, or improved commercial opportunities for UK firms in the region.

3.13 Research-based academic links are often more successful where the benefits of collaboration are mutual and where the intellectual and other resources are relatively well matched. Therefore academic links with the newly industrialising countries such as Brazil, India and Mexico are more frequently research based often involving sophisticated application-driven applied research. In these cases the UK Research Councils and their institutes can be involved, along with their analogues in the partner country. For example, the Indian Institute of Chemical Technology (IICT) and Portsmouth Polytechnic are collaborating on the development of DNA footprinting and thermal denaturation in order to develop anti-cancer drugs. The Indian side of the collaboration is fully funded by the Indian Council for Scientific and Industrial Research, and the project as a whole enjoys support from the Cancer Research Campaign in Britain.

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4. THE BRITISH COUNCIL'S WORK FOR INTERNATIONAL SCIENCE AND TECHNOLOGY PROJECTS

4.1 *Rationale*

In order to further its corporate aims, the British Council undertakes overseas education and training projects and thus helps increase the UK's market share. ODA and the multilateral donor agencies are our major clients. Such projects usually include exchanges for training and consultancy, and frequently encompass equipment provision.

4.2 *Project Management for the Overseas Development Administration*

ODA funded training ameliorates general manpower shortages in S&T in developing countries. The ODA's current policy is to concentrate aid into projects that are carefully formulated and require efficient phasing and integration of all project inputs. In relevant areas the ODA often engages the British Council to implement projects, drawing on British educational and specialist resources. This work is undertaken on a contractual basis under the terms of a Memorandum of Understanding agreed between the ODA and the Council in 1989. The Council provides a wide range of management services for project implementation at home and overseas that include arrangements for training, consultancy and equipment provision (usually in association with procurement agents), installation and commissioning. The Council is also well placed to assist the ODA in the identification and design of projects. The Council is currently implementing 118 S&T projects to a total value of more than £58 million, but this includes projects directed towards the health sector and education. A small number are research based projects or include a research component (Annex 8 and 9).

4.3 *Paid Educational Services (PES)*

The British Council furthers its objectives by securing educational and training contracts and implementing them on behalf of overseas governments or government agencies using loan or grant finance from multilateral development agencies such as the World Bank, the Asian Development Bank and the European Commission. The Council identifies project opportunities and competes for these contracts, normally against international competition. If successful the Council then acts as managing agent drawing upon UK resources to provide the necessary inputs. The major PES projects in S&T are currently located in Indonesia, Turkey, China and Egypt. Under the World Bank funded "Universities II" project of the Indonesian Government, the British Council has undertaken project work worth £5.5 million. This has enabled 170 staff from Indonesian Universities to undertake postgraduate and research training in the UK, mainly in biotechnology and engineering. The value of projects in S&T currently under implementation is almost £22 million but includes projects in technical, secondary and higher education (Annex 10).

5. EXCHANGE OF INFORMATION

5.1 *The British Council's Information Work*

Information is used extensively to support the British Council's programmes, particularly exchanges, English language teaching and education contracts work. The Council has 118 libraries and information services in 71 countries and offers information on educational courses in Britain in most of the other countries in which it operates. In April 1989 the total book stock of these libraries and information services was 2.107 million, and 7.876 million books and other stock items were loaned to 427,115 library members during 1988-89. A substantial proportion of the total stock and total loans were in S&T subjects. During 1988-89, Council offices overseas answered a total of 454,043 general enquiries and 337,427 requests for information on educational opportunities in Britain.

5.2 Following a major review of the British Council's information services, our offices overseas are increasingly targeting current awareness information to key groups and individuals, especially those in S&T. Extensive use is increasingly being made by Council offices overseas of information available through new technology, notably by the local supply of databases on CD-ROM. Of those currently in use, 29.5 per cent cover S&T exclusively. In summary, the database provide cover for:

5.2.1 Scientific, technical and medical journal literature, for example MEDLINE (references and abstracts covering international medical literature, a high proportion of which is British), or CAB Abstracts (international agricultural literature, compiled by Commonwealth Agricultural Bureau International);

5.2.2 Bibliographies of British books and journals on all subjects, including science, technology and medicine, for example BOOKBANK (British Books in Print), BNB (British National Bibliography) and Ulrich's international directory of periodicals;

5.2.3 Directories of the research interests and biographical details of British scientists and technologists, for example BEST (British Expertise in S&T) on CD-ROM and CRIB (Current Research in Britain) available on line from the British Library;

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5.2.4 Information on postgraduate, undergraduate and further education courses available at British universities, polytechnics and colleges linked on a Department of Education and science supported database, ECCTIS. From 1990 ECCTIS will include comprehensive information of courses on scientific, technological and other courses from standard printed sources such as Graduate Studies, Directory of Further Education and Degree Course Guides. By the end of 1990 ECCTIS will also contain the British Council's own major sources of educational information, including: Information Service sheets; English Studies Information Service sheets; a new series of Medical (Education) Information sheets; and a database of British Short Courses.

5.3 To supplement these databases the British Council is also co-operating with the British Library's Directorate-General for Science, Technology and Industry and other major information providers in Britain to supply at favourable prices photocopies of off-prints of the articles identified through CD-ROM and online database searches. The Council is advising its offices overseas on the wide range of commercially-published information updates, packs, current awareness materials and other publications that can be used to supply information pro-actively to target groups, institutions and individuals in their host countries.

5.4 The importance of scientific information to development is increasingly being recognised by developing countries and development agencies. The British Council's information services are designed to meet this growing demand and to support its own programmes of exchange and co-operation in S&T. The aim is to meet directly the specialist needs of key groups of researchers and policy makers for information about S&T in Britain via British Council libraries and services. British current awareness scientific literature such as *New Scientist*, *Nature*, the *Lancet* and the *British Medical Journal* can usefully be supplied to selected individuals overseas.

6. EXAMPLES OF COUNTRY SCIENCE AND TECHNOLOGY PROGRAMMES

6.1 *France*

6.1.1 In France, the British Council science programme aims to develop durable bilateral S&T relations, and to promote appreciation of British scientific strengths. The French have similar objectives and therefore much of the activity consists of jointly funded links.

6.1.2 Most grants for travel are awarded for research and institutional links (49 per cent in 1989-90) but a number are intended to establish personal contacts in order to consolidate research proposals for EC bids (25 per cent). Bids covered the following EC programmes in 1989-90: FLAIR, ECLAIR, FORESTRY, BRITE-EURAM, STEP, COST, BRIDGE, DRIVE, EPOCH, Competitvity in Agriculture and twinning proposals.

6.1.3 In March 1989 the jointly funded Alliance programme was established with the French Ministry of Foreign Affairs to support exchange visits for joint research collaboration in S&T. For 1990, forty three joint projects were selected at a total cost of £168,000. The programme is planned to expand over the next two years. French funding for the scheme is drawn from the Medical, Agricultural and National Research bodies, and the relevant Ministries. In the first year, demand was greatest in medical, chemical and life sciences. None the less, agreed projects ranged from low temperature physics and transition metals, bimetallic thin films, II-VI semiconductors and high efficiency solar cells, to applied fish biology, recombinant DNA studies and plant physiology.

6.1.4 France and Britain clearly stand out in Europe for their success in bids for the ERASMUS programme. A number of British Council assisted visits (21.5 per cent in 1989-90) include preparation for the exchange of students for research training as well as staff exchanges for the development of joint courses. The demand in France from the elite engineering schools for assistance in sending their graduates to Britain is high and there is a unique Council award scheme specifically for these young engineers.

6.1.5 *British Council Objectives*

The objectives of the British Council in France in S&T are to facilitate personal contacts between British and French researchers and links between institutions by responding to or initiating support for inward and outward visits with the following purposes:

- exploratory visits to investigate research/teaching links
- specific joint research collaboration, leading to joint publication
- research discussion for the formulation of programme proposals for submission to EC or other bodies

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- developing institutional links for the exchange of students under ERASMUS/COMETT, for discussions related to credit transfer, award of *doubles diplomes*, creation of new joint degrees/diplomas or arranging industrial placements. (See tables).

6.1.6 The British Council in France provides information about British research activities and interest in S&T, and assists British groups seeking further contacts with France. The Science Officer liaises with the Technology Counsellor in the British Embassy, one result of which has been a series of high level lectures in S&T given by eminent British speakers in a programme entitled "Image of Britain". In addition the Council funds the Prix France-Britannique, which is presented by the Ambassador and awarded in alternate years.

6.1.7 British Council Funded Science Exchanges in France in 1989-90

TABLE 6.1.1
Statistics by Programme

	Visits to France	Visits to Britain	Funds £	Average £
Grants-in-aid	89		16,730	188
Academic Interchange with France Scheme	14		5,101	364
Selection Committee Costs for Alliance	7		2,707	387
Alliance Projects	146 projected	¹ (156)	¹ 73,540	504
Total to France	256		98,078	
Travel grants		36	8,384	233
Visitorships		6	3,077	512
Awards:				
BC Fellows		25	33,782	1,351
Grandes Ecoles Bursaries (3 months)		25	24,722	989
Grandes Ecoles Final Year Fees Awards		38	58,700	1,545
Prix Franco-Britannique		1	4,000	4,000
FCOSAS		13	41,165	3,166
Total to Britain		144	173,830	
		Total Visits: 400	Total Budget: £271,908	

¹Funding matched by French for French visits. Additional £22,129 to be spent in 1990-91 for these agreed projects.

TABLE 6.1.2
Science and Technology Exchanges by Subject in 1989-90

Subject	Alliance Projects Per cent	Travel Grants Per cent	Awards Per cent
Agriculture, veterinary	7	16	8
Life Sciences	16	17	7
—medicine	7	8	2
Chemistry	21	9	7
Environment, Earth Sciences, Space	11.5	4	4
Physics	9.5	10	5
Materials	9.5	2	1
Engineering, Maths, Computing	18.5	30	66
Miscellaneous (e.g., Architecture, international relations visits)	—	3	—

TABLE 6.1.3
Purpose of Science and Technology Exchanges

			To establish joint courses/exchanges of students Per cent	Special meeting/ Course faculty Per cent
Research Collaboration				
Direct Per cent	With EC proposals Per cent	With student exchanges Per cent		
24	25	20	21.5	9.5
Total visits: 100 per cent				

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6.1.8 *Examples of Interest*

- A Travel Grant of £150 awarded to Professor Holt of Newcastle-Upon-Tyne University for the preparation of an EC submission under MAST (Marine Science and Technology Initiative) as task leader for Algorithm Development and Implementation aspects led to a successful application and Professor Holt's group will receive £109,000 over two years.
- A Travel Grant was given in September 1989 to Professor Sainsbury, Bath University, to visit Institut Curie, Paris. A joint application to the EC (in cancer research) for twinning was unsuccessful, but an EC postdoctoral 1-year award was given to a researcher from Paris to visit Bath, for which Bath was to receive 10,000 ECU.
- A Travel Grant was awarded in July 1989 to Dr P J Quinn, King's College, London, for research collaboration with CNRS Paris in studies on the action of platelet activating factor on model membrane systems. The Daresbury Synchrotron Radiation Source was used at the UK end. An EC twinning proposal was to be prepared between London, Paris, and institutions in Spain and Portugal. Dr Quinn's link with Spain was consolidated by a British Council Acciones Integradas award.

Links may also assist developing country work. As an example, Dr Blake from Wye College visited Montpellier to discuss potential collaboration on coconut palm cultures. Eventual collaboration will involve ORSTOM (the French agency for development), the Philippines and possibly the ODA.

6.1.9 *International Scientific Programmes*

In France, ISPs mainly mean EC programmes. There has been little support given to UN agency activities, since these are largely self-funding. Similarly, there has been only very occasional support given directly for visits to ESA, ILL, ESRF and EMBL. There are, however, examples of British Council activities in France that relate to ISPs:

- A grant-in-aid was given early in 1990 to Dr Hunter of Manchester University to visit Grenoble to establish Britain's input into the development of a European Training Course for users of large facilities directed at young European scientists. (Manchester University has links with Daresbury Laboratory).
- Visits have been assisted between Reading and Montpellier University in Inorganic Chemistry to develop a NATO Advanced Study Institute programme.
- A number of links are related to Mediterranean development, e.g., Lancaster, Montpellier, Aix and Grenoble Universities on modelling rain catchments.

6.1.10 *Relations with UK Research Councils*

The British Council in France maintains good contacts with the Research Councils and the Royal Society in order to ensure optimum use of available resources for exchanges. The British Council has been involved in inviting and arranging visits to stimulate contact and familiarisation in France with British practice and policies, e.g., by the Chairman of SERC.

6.2 *India*

6.2.1 *Introduction*

The British Council in India is the Council's largest overseas operation with a total budget of some 25 million per annum (including funds administered on behalf of ODA). The Council's principal aims in S&T are:

- to contribute to India's economic, social and educational development by making British skills and expertise available;
- to provide information on Britain and its scientific resources through libraries and book promotion;
- to increase the number of Indians coming to Britain for further scientific studies.

The Council emphasises the need to support and efficiently manage aid work undertaken for the ODA. It also seeks to encourage an appreciation and understanding of Britain amongst future generations of opinion formers and decision makers.

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6.2.2 The British Council's Work in Science and Technology

6.2.2.1 Priority is given to those areas of S&T that underpin socioeconomic development in India, where there is established expertise and interest in Britain and where the appropriate infrastructure exists to support them. Key topics being developed with the agreement of the Government of India include biotechnology (e.g., vaccine production and recombinant DNA technology), air and water pollution and the rehabilitation of derelict land, computing and control, materials technology and the detection and treatment of cancers. The British Council employs its government grant to fund exchanges of persons in these topics: in 1989-90, 109 Indians visited Britain and 165 Britons visited India as part of the Council's own support for co-operation in S&T.

6.2.2.2 In addition, the British Council manages ODA funded links in higher education between Britain and India, mainly in the same priority areas. Thirty eight such scientific links supported fifty three visits to Britain and fifty visits to India in 1989-90. A further seventy six science links are being explored.

6.2.2.3 The British Council also manages thirty five ODA technical co-operation projects in science and technology as part of the Government's aid to India. The estimated value of projects in research, development and education in the fields of renewable natural resources, environmental pollution, medical research, science, engineering and technology but excluding industrial training, agricultural extension, primary health and basic education provision is £15 million. A further thirty two projects are under consideration. The Technical Co-operation Training Programme provided 209 training awards in Britain in S&T during 1989-90, mainly related to projects.

6.2.2.4 The FCOSAS programme supported visits to Britain by twenty three Indian specialists in S&T in 1989-90.

6.2.3 Priorities for ODA Projects

6.2.3.1 ODA Technical Co-operation projects are identified and appraised by ODA geographical departments and review missions. British Council staff often contribute to reviews. Recent sectoral missions to India have examined health (1987), renewable natural resources (1988) and science and technology (1990) in India and made recommendations for future activity and priorities. A general Memorandum of Understanding between the Indian and British governments provides a useful "umbrella" for the initiation and implementation of bilateral science and technology projects. The Research and Development projects agreed under the Memorandum involve joint funding and other inputs, and must be approved in India by the parent ministry and the Ministry of Finance. Projects therefore lie in the Government of India's priority areas, typically in fields where the Indian authorities have good contacts with the UK and appreciate the benefits of collaboration.

6.2.3.2 The Government of India attempts to balance the requirements of the truly disadvantaged with the need to keep in touch with scientific and technological advances. British aid therefore contributes to local costs of poverty-alleviating projects whilst Technical Co-operation assists the development of the Indian science base.

6.2.4 The Origins of Bilateral Scientific Activity

6.2.4.1 The identification of priorities and projects may result from ODA review missions but requests for assistance in priority areas also arise from Indian institutions. This is often the result of earlier contacts with Britain such as training attachments or academic links managed by the British Council. British Council staff in India are in close contact with Indian institutions and, knowing ODA policies, can encourage appropriate proposals; staff can also assist with project development. The ODA frequently requests the British Council to assist in project formulation although project appraisal is undertaken by the ODA itself. The ODA delegates the day-to-day management of project implementation to the British Council when appropriate, while monitoring and evaluation are undertaken jointly by Indian and British professionals.

6.2.4.2 The process is complex but helps to ensure that projects conform to priorities, have realistic objectives and run to schedule. Administration in the British Council is mainly provided by locally engaged staff in order to minimise costs whilst maintaining quality. Scientifically qualified British Council staff in Britain with a good knowledge of British resources also facilitate project activity by identifying and arranging the provision of consultants, training and equipment as necessary.

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6.2.5 *Examples of Interest*

6.2.5.1 It was proposed in 1978 that a microprocessor applications programme be established at the Indian Institute of Technology, Delhi (IITD) to provide training courses for Indian engineering college teachers and to identify application areas for microprocessor technology. The British Council funded visits by British academics to IITD that led to a proposal to establish a Centre for Microprocessor Education Training and Research at IITD. IITD submitted the proposal to the Government of India with the objective of negotiating a formal British collaborative project. Pre-project visits to Britain were made by the staff of IITD during 1986-87. The project was approved by ODA and the Government of India in April 1988 and runs from 1988 to 1993 (total value £500,000).

6.2.5.2 In 1981 the British Council funded a visit to India by a senior lecturer from Thames Polytechnic under its scheme for specialist visitors. He attended an international conference on erosion and industrial processes. Subsequent visits by staff from Thames Polytechnic took place from 1982 to 1985, again funded from the Council's government grant. The lack of appropriate research facilities for pneumatic conveying in India and the need to support dense phase conveying systems being developed in Indian industry became apparent. A small project was therefore submitted to the Government of India by IITD and ODA agreed funding in late 1984. The project has met a real industrial need and has also resulted in several Indian industrial concerns placing orders with British companies for pneumatic conveying equipment.

6.3 *Japan*

6.3.1 *Science and Technology in Japan*

6.3.1.1 Japan's impressive achievements in technology have helped to create a very successful economy. However, Japan still perceives itself as weak in basic science. Official science policy in Japan therefore emphasises the strengthening and internationalising of basic science, and government budgets and schemes are being created for external collaboration. There is thus a major opportunity for greater Anglo-Japanese co-operation across a wide range of S&T. The major constraints are mutual lack of knowledge of what the other has to offer, especially of Japanese science by the British, and the lack of time of eminent scientists in both countries to undertake exploratory visits that might encourage Anglo-Japanese collaboration.

6.3.2 *The British Council's Science and Technology Work*

6.3.2.1 The British Council in Japan aims to promote Britain as a partner in scientific and technological research and development. Its work focusses on informing Japanese scientists about recent research developments in Britain, and encouraging collaboration involving shared facilities, thus reducing research costs and broadening the range of research opportunities available in Japan to British scientists. Target groups in Japan are established academics and their postdoctoral assistants in the more senior national universities, and researchers in major government research institutions. In Britain, the beneficiaries of the Council's activities are typically professors in universities and researchers in Research Council institutes.

6.3.2.2 The British Council attempts to set up projects across a wide range of S&T (including agriculture, the environment and medicine) and across all parts of Japan. The British Council selects for collaboration promising Japanese research groups that have been identified by UK scientists and have good scientific reputations or major research programmes. There are increasing opportunities for British researchers to attract research funding and support from Japan for collaborative research, either from industry or Government schemes. The Council's information work in S&T is limited because most target groups in Japan are already well informed and have excellent access to the international scientific literature.

6.3.2.3 Unlike many industrialised countries, the UK has no Government-level agreement with Japan in S&T. However, there are a number of successful UK-Japan agency-level agreements, for example: SERC—Monbusho (Japan Ministry of Education, Science & Culture); Royal Society—Japan Society for Promotion of Science (JSPS) and Royal Society—Science and Technology Agency. The British Council works closely with all of these organisations (both British and Japanese) to help to maximise the effectiveness of UK-Japanese collaboration and to ensure that the British Council's exchange and collaborative programmes are complementary. The Council actively supports efforts to broaden these inter-agency agreements and to seek new areas and opportunities for collaboration.

6.3.2.4 In 1989-90 the British Council used its Government grant to fund 89 Japanese visits to Britain and 114 visits from the UK to Japan in S&T. Other funds channelled through the British Council supported a further 18 visits to Britain, and 79 visits by British scientists to Japan, resulting in a total of 300 exchanges of persons. The Royal Society, through its programme with the JSPS, is the other main British body supporting exchanges of persons. SERC also supports collaboration but is limited by the demands on its budget.

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6.3.3 *Consequences of S&T Activity*

6.3.3.1 One example of the benefits that accrue to British science as a result of the Council's "bridge building" activity is the seven year Muon science project at the Rutherford-Appleton laboratory. This involves £11 million of Japanese money for building a superconducting tunnel onto a muon source at Didcot. The Chairman of SERC discussed the project with the Japanese Government and researchers during a visit to Japan organised by the British Council. The recent increase in the British Council's government grant has enabled our Tokyo office to fund a small bilateral exchange programme in order to facilitate discussions and meetings to plan the project. The first sub-project is now agreed and the others are being developed.

6.3.3.2 A five-year, £10 million project between the Japanese Research & Development Corporation (JRDC) and a joint research team from Cambridge University and Imperial College was agreed as a result of contacts identified, and exchanges sponsored by, the British Council. The JRDC fund is new and is intended to support the external costs of Japanese international collaboration in S&T. The JRDC is providing £5 million towards the cost of this project in Britain. The research area is the development and applications of electronic materials prepared by the deposition of atoms in single layers on different materials. The British contribution to the project is the staff, equipment and facilities already in existence at the two laboratories. The British Council Science Officer in Japan was instrumental in persuading the JRDC to consider UK research groups as potential collaborators in the project when the Japanese were primarily seeking collaboration with US research groups. The Council used its own funds to enable Japanese and British staff to meet to discuss the proposal in detail and reach agreement.

6.4 *Turkey*

6.4.1 *Introduction*

Turkey, a newly industrialising country, aspires to join the European Community. Economic difficulties include a population of 54 million that is growing by 2.5 per cent per annum while the growth in GNP was only 1.1 per cent in 1989. Agriculture contributes 17 per cent of GDP but employs 56 per cent of the workforce, while industry and services contribute 36 per cent and 47 per cent to GDP respectively. The Government of Turkey has pledged to increase funding and staffing in science and technology to the tenfold higher levels of other developed countries. Priority sectors include microelectronics, biotechnology and new materials.

6.4.2 *British Council Objectives*

The science and technology programme in Turkey aims to create a positive experience of Britain and an increased take-up of British goods and services in education, training, research and publishing. It is intended to help Turkey to become an important European trading partner of Britain. The Council thus supports Turkey's S&T activity in the above priority sectors, in subjects of commercial interest to Britain, and in macro-level fields such as policy formulation, research management, university-industry links and environmental issues.

6.4.3 *The Science and Technology Programme*

6.4.3.1 Science qualified British Council staff regularly visit key institutions such as the state Planning Organisation, various ministries, the Turkish Science and Technology Research Council and the universities. Needs are thus identified and information is provided as appropriate from local or UK sources. For example, Environmental Impact Assessment (EIA) will shortly become a legal requirement for investment projects in Turkey. Details of British expertise have been provided to the newly-upgraded Undersecretariat for the Environment. This is likely to lead in the short term to uptake of UK training proposals, then to development of collaborative research in water pollution and remote sensing, and in the long term to a major EIA study of the GAP scheme—a massive hydro-power and irrigation project in south-east Turkey.

6.4.3.2 Scholarship Programmes, mainly from the Foreign and Commonwealth Office Scholarships and Awards Scheme (£990,000 in 1990-91), are primarily employed to respond to development and training needs. Some 30 per cent of awards (estimated £184,000) are made on a competitive basis to applied scientists and technologists in priority areas. Candidates are selected from amongst those most likely to become leaders and opinion formers in the longer term. The British Council makes an effort to maintain contact with returned scholars.

6.4.3.3 Short visits to Britain assist Turkish scientists and technologists who would otherwise lack access to modern equipment, scientific literature and expertise. The activity is focussed on priority subjects and most visitors must contribute to the costs of their visitorships. Demand exceeds the availability of funds (£38,050 and 57 visitors in 1989-90). Study tours by senior officials have examined the workings of the

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National Health Service system with a view to making Turkish decision-makers aware of British expertise, consultancy and training capacity. Turkey is about to launch a project in health care provision in selected regions, with loans from the World Bank.

6.4.3.4 Turkey is keen to host international conferences, and British speakers are greatly valued. A specialist programme enables the Council to meet requests to identify and fund appropriate British experts, mainly with travel grants. Some pro-active suggestions made by the British Council are taken up: for example, a British specialist in university-industry collaboration will make presentations to government officials, academics and industrialists later this year. This programme supported 71 British specialists in 1989-90 at a cost of £13,300. Demand greatly exceeds supply.

6.4.3.5. The Academic Links Programme in Turkey, supported by the ODA, has provided several examples of small-scale collaborations that have led to much larger projects. Criteria employed when considering links include the quality of the proposal, mutual benefit and interest, developmental importance for Turkey, subject area not duplicating existing links, and the track record of the partners. Expenditure in 1989-90 was £19,800 on 10 links in S&T.

6.4.3.6. External Funding Agencies such as the World Bank, EC, UNDP and NATO provide finance for developmental projects in Turkey. The British Council has improved collaboration between Turkey and Britain in technical education by means of Paid Educational Services (PES) contracts for the provision of technical assistance in two projects: total revenue accruing to Britain should exceed £7 million by 1992. British consultants have written new curricula in various engineering-related subjects at secondary and post-secondary education levels; and large numbers of Turkish teachers have undertaken nine month training periods in Britain. Attitudes to Britain among government officials and teachers have improved and standards of technical education have risen. EC funds have enabled British Council sponsored academic link collaborators to develop projects of significant economic benefit in such areas as the treatment of serious parasitic diseases of cattle. UNDP programmes in agriculture have financed large numbers of trainees in Britain, partly as a result of information supplied by the British Council; and current discussions may lead to joint UN/British Council funding of a science park project. NATO money also enables British specialists to contribute to and participate in Advance Study Institutes and Research Workshops in Turkey; contacts have often been established earlier through British Council programmes.

6.4.4. An Example of Interest

A link between the Chemistry Department at Birkbeck College and the department of Environmental Engineering in Ankara University is directed towards the development of water quality control and environmental management in Turkey. The focus of the link is the training of junior academic staff and the planning and execution of research using analytical facilities not available to Ankara. Research has concentrated on assessing trace metal concentrations in the Goksu River by means of Inductively Coupled Plasma (ICP) Emission Spectrometry and the results have been submitted for publication. Since 1988, the academic link has assisted in a NATO project on Pollution Assessment and Waste Management, and the academic link had also been able to participate in the UNEP MED-POL (Mediterranean Pollution) project.

6.5 Yugoslavia

6.5.1 Examples of Interest

6.5.1.1 Boris Kidric Institute (Belgrade)/Strathclyde University/Heriot Watt University

From reading each other's papers, groups in Boris Kidric and Strathclyde started correspondence on Carbon Dioxide Lasers. From 1985 to 1988 the Boris Kidric Institute, the Yugoslav Science Foundation and the Yugoslav Science Council funded visits to Strathclyde, leading to the drafting of an EC proposal. Meanwhile, the British Council had awarded a grant for a visit from Boris Kidric to Heriot-Watt that led to a tripartite proposal for EC funding under the EC Yugoslav Co-operation Agreement in the field of novel mixtures of medical excimers employing advanced electronics for carbon dioxide lasers. The contract with the EC being signed, the British Council helped Boris Kidric to send a visitor to Strathclyde for discussion of implementation from 1 August 1990. The EC project covers personnel, equipment and consumables to 150,000 ECU (£100,000) over two years. An extension request for the development of a patentable process of interest to carbon dioxide laser manufacturers would be one possible outcome.

Although SERC had previously financed such work, a recent alpha-rated project had not been supported for lack of funds. The British Council's contribution of £2,700, however, had attracted £10,000 from Yugoslavia that led to the EC project. No method of project funding had been available from 1985 until the EC joint project procedures arose.

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6.5.1.2 *Belgrade Medical Faculty/St Thomas's Hospital (London)/King's Cross Hospital (London)*

A chance meeting in London of one Yugoslav and two British researchers interested in drugs and the blood-brain barrier led to 10 visits to Britain (£4,700) and 12 visits to Yugoslavia (£2,500). The exchanges involved eight to 10 scientists from several institution, research, training and generous donations of equipment from the British. The Wellcome Foundation contributed £40,000 and funded an international conference in Belgrade in 1989, and the British Council awarded a fellowship for study in London in the same year. By June 1990, twenty joint papers were close to publication. Sandoz, the pharmaceutical manufacturer, contracted the University of London to undertake research (£2,000) from 1987-90, and a large US pharmaceutical firm has funded two senior research posts in the same field for several years (£30,000 per annum).

The link remains strong and has called upon the British Council when no other source of funds has been identifiable. Medical Research Council support has not been available to assist this area.

6.5.1.3 *Mechanical Engineering Faculty (Belgrade)/Cranfield Impact Centre*

A Cranfield lecturer visited Belgrade with British Council support in 1974. He was impressed by one particular Yugoslav researcher, Mr Kecman, who then received a generous scholarship, obtained his PhD at Cranfield on the crashworthiness of buses and vehicle design and was subsequently contracted to do research work at Cranfield. Joint research was maintained from 1984 to 1989 on his return to Yugoslavia, involving seven visits to Britain and one visit to Yugoslavia supported by the British Council (£2,640), focussed on software design for the investigation of vehicle safety. As a result, General Motors awarded a large research contract (£100,000) to Cranfield, where Dr Kecman was working on contract in June 1990. Cranfield hopes to take on more research contracts and make more links with Yugoslavian and other East European countries.

7. TOPICS OF PARTICULAR INTEREST TO THE COMMITTEE

7.1 *The advantages and disadvantages of joining ISPs*

7.1.1 Increased British involvement in major ISPs should enhance the standing of British science and scientists overseas, thus helping the British Council in its aim of promoting an appreciation of Britain in other countries. The participation of British researchers in such programmes should also increase interchange, which should again help to promote understanding and contact with colleagues overseas.

7.1.1.1 For smaller bilateral programmes of collaboration such as those run by the Council, the potential advantages to the British institutions and individuals concerned are numerous although one should also consider the costs. Institutions can benefit from fees brought in by overseas trainees, students and researchers and consultancy fees paid to staff. Institutions and staff also gain from shared research effort and facilities. Overseas experience can provide other benefits too, such as greater access to funded projects that demand such experience. Collaboration with overseas countries can also provide access to other natural and social environments. Besides the promotional benefits of collaboration, research in some areas provides commercial benefits to the UK either directly from the research or through the sales of equipment. In addition, small scale bilateral collaborations can be a preparation for participation in larger internationally funded projects such as those of the European Community.

7.1.1.2 The disadvantages of such programmes are that collaboration over a distance can be expensive and difficult to manage, thus absorbing staff time and research, training and other resources which are then not available for national efforts.

7.2 *The advantages and disadvantages of hosting large facilities*

The British Council has no responsibility for providing large facilities but would expect them to attract to the UK specialist visitors from overseas, and so raise Britain's science profile overseas. This would be supportive of the Council's general aims. Such facilities can provide good centres for training overseas scientists.

7.3 *The machinery for the establishment of international programmes*

7.3.1 The British Council has little formal role to play in large scale international programmes, but might contribute to exploratory scientific exchanges of scientists, for example by helping British participants to attend meetings overseas. However, the Council has helped to encourage the internationalisation of major British scientific facilities by assisting the early stages of research collaboration with overseas scientists.

7.3.2 For smaller scale and largely bilateral programmes of the collaboration the Council is one of the main British organisations funding the exchanges of scientists, thus helping to initiate and sustain collaborative international research. The Council is well placed through its overseas offices to assist other

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British organisations in finding partners. In Cultural Exchange Programmes (CXPs) the British Council is generally the official lead agency representing the interests of the UK Government. Many CXPs include scientific programmes. Similarly, the Council also has a number of inter-agency S&T agreements with bodies overseas, generally covering scientific exchanges and research collaborations. In Europe, British Council "pump-priming" funding is increasingly being used to develop relations and proposals for eventual submission to the European Community for larger scale funding.

7.4 *The forum in which the decision to participate in ISPs is reached*

Decision-making on British Council participation in any major programme of co-operation to be funded from its Government grant, and questions of general policy, are taken by the British Council's Board. However, much of the decision making associated with the implementation of programmes is in practice taken by Council staff in the country concerned. Policy and key decisions associated with agency programmes are the responsibility of the donors, for example ODA and FCO.

7.5 *Impediments within the UK to engaging in ISPs*

Co-operations sponsored by the British Council generally arise when a mutuality of interest has been established between the potential British and overseas partners. However, bilateral research collaborations can be difficult to initiate when research outcomes may have commercial significance. Security concerns and COCOM restrictions may also be a barrier.

7.6 *Impediments in other countries to their engaging in ISPs*

In many Eastern block countries and some developing countries the lack of hard currency for training and other fees, international travel and costs, research equipment and consumables can be a real barrier to greater collaboration with the industrialised countries. Some countries lack appropriate skills and facilities for co-operation although there might be a quite compelling need to pursue it. Inadequate language skills is an important barrier in many countries. Lack of adequate protection of intellectual property rights in some developing and newly industrialised economies can also discourage British and other partners.

ANNEX 1

COUNTRIES WITH LONDON-APPOINTED SCIENCE QUALIFIED AND SCIENCE OFFICERS AT POST IN 1989-90

Botswana	Mozambique
Brazil (2)	Nigeria (3)
Brunei	Norway
Cameroon	Oman
China (2)	Pakistan
Egypt (2)	Philippines
France	Poland
Greece	Singapore
Germany	South Africa
India (7)	South Pacific
Indonesia (2)	Spain (2)
Israel	Sri Lanka
Italy	Sweden
Japan	Tanzania (2)
Kenya (3)	Turkey (3)
Korea	USA
Lesotho	Venezuela
also Swaziland	Yugoslavia
Malaysia	Zambia
Mexico	Zimbabwe

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ANNEX 2

Fellowships in 1989-90

Source of Awards	Physical Sciences	Biological Sciences	Engineering & Technology	Agriculture	Medicine	Total
British Council	163	106	170	79	171	689
Commonwealth Scholarship Division	175	126	197	121	271	890
European Commission	40	11	95	88	60	294
Foreign & Commonwealth Office	234	89	358	96	148	925
Overseas Development Administration	76	23	88	14	60	261
United Nations	200	90	243	291	77	901
Client-Funded Training	192	51	383	137	137	900
Paid Educational Services	58	43	267	37	7	412
Total	1,138	539	1,801	863	931	5,272

ANNEX 3

Visitorships in 1989-90

Length of Award, Days	0-7	8-14	15-21	22-28	29-35	36-42	43-49	50+	Total
Physical Sciences	34	61	37	12	20	7	11	22	204
Biological Sciences	18	29	20	8	16	9	3	12	115
Engineering and Technology	43	88	45	11	16	16	7	9	235
Agriculture	14	54	24	8	8	3	7	9	127
Medicine	38	83	49	26	19	7	6	26	254
Total	147	315	175	65	79	42	34	78	935

ANNEX 4

Study Tours in 1989-90

Source of Funds	Study Tours	Number		Average No. of Participants	Total £000	Cost	
		Participants				Per Study Tour £000	Per Participant £000
Fully BC Funded	17	78		4.6	103.6	6.09	1.33
Partly BC Funded	6	48		8.0	36.9	6.15	0.77
Client Funded	2	11		5.5	9.0	4.5	4.49
ODA Funded	2	15		7.5	42.5	21.3	2.84

ANNEX 5

Specialist Tours in 1989-90

Subject Areas	Specialist Tours	Travel Grants	Grants In-Aid	DOH	ODA	Inward Visits	Total No. of Specialists
Science and Technology	250	384	33	15	75	76	833
Agriculture	15	43	9	—	19	—	86
Medicine	70	109	10	29	38	—	256
Total No. of Specialists	335	536	52	44	132	76	1,175
Estimated Costs, £000	232.7	259.9	25.8	17.5	509.6	28.7	1,074.2
Average Cost Per Person, £000	695	485	496	398	3,861	378	

(This table incorporates head office-administered specialists but not overseas-administered specialists.)

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[Continued]

ANNEX 6

British Council Specialist Courses in 1989-90

<i>Subject Area</i>	<i>Number of Courses</i>	<i>Number of Participants</i>	<i>Average Number of Participants Per Course</i>
Science and Technology	4	118	29.5
Medicine	22	589	26.8

(These courses are largely self-financing.)

ANNEX 7

Technical Co-operation Programme in 1989-90

<i>Level</i>	<i>Physical Sciences</i>	<i>Biological Sciences</i>	<i>Engineering & Technology</i>	<i>Agriculture</i>	<i>Medicine</i>	<i>Total</i>
Doctorate	390	211	426	206	140	1,373
Post-Doctoral	122	49	88	44	33	336
Non-Qualification	563	209	1,342	532	581	3,227
Visit Only	256	147	330	153	297	1,183
Total	1,331	616	2,186	935	1,051	6,119

ANNEX 8

PROJECTS

ODA Projects as at May 1990

	<i>Current</i>	<i>Proposed</i>
Number of projects (including health care and secondary education)	118	16
Total value of projects	¹ £58,611,000 (plus £286,000 capital aid)	£37,908,000

¹A small number of current projects had not been assigned a value in May 1990.

ANNEX 9

PROJECTS

FCO/ODA Projects—Current and Proposed (May 1990)

<i>Poland</i>		<i>Czechoslovakia</i>	
<i>Subject Area</i>	<i>Value £000</i>	<i>Subject Area</i>	<i>Value £000</i>
Agriculture	1		
Farming Co-operatives	50	Environment Seminar	25
AIDS Care	50	Environment Study Tour	25
General Scholarship Scheme	500		
Total	600	Total	50
		Total	£650,000

¹Cost still uncertain.

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[Continued

ANNEX 10

PROJECTS

*Paid Education Services (non-ODA)
Contracts Under Implementation in 1989/90*

Funding Agency	Number of Contracts	Average of total Value	Value of Contracts	
			Percentage Value	Total £000
World Bank	18	987	81.0	17,800
E.C.	3	867	11.9	2,600
Other	4	387	7.1	1,500
Overall	25	876	100.0	21,900

*Contracts Completed in 1989/90
(included in the above table)*

Funding Agency	Number of Contracts	Average Value £000	Value of Contracts	
			Percentage of total	Total Value £000
World Bank	3	66.2	89	198.5
E.C.	2	9.0	8	18.0
Other	1	3.0	3	6.0
Overall	6	37.1	100	222.5

Examination of Witnesses

SIR RICHARD FRANCIS, KCMG, Director General, DR JOHN RICHARDS, Director, Science and Technology Department, DR JUNE ROLLINSON, Science Officer France, and DR ROBIN SOWDEN, Senior Science Officer, British Council, called in and examined.

Chairman

120. Sir Richard, we are grateful to you for coming to help us today. We are very grateful to you for your very full written report to us. It does not leave much to say by way of questions. Am I right in saying you would regard the British Council's role in the whole field as being a lubricant, that you help the process but do not yourself initiative it? Do you see it as being helpful in both directions, that is, helpful to British scientists and helpful to scientists overseas in having contacts with this country?

(*Sir Richard Francis*) My Lord Chairman, thank you for the opportunity to address the Committee. Could I in parenthesis introduce myself and my colleagues? I am the Director General of the British Council and Chief Executive and I work to the Board. On my left is Dr John Richards, Director of our Science and Technology Department which is our principal advisory department in London. He was previously science officer in India and Japan, and latterly was on the staff of the Chief Scientific Adviser to the Cabinet Office. On my right is Dr June Rollinson, Science Officer France. Before that, she was Science Office in Rome, and before that Science Officer in India. On my far left is Dr Robin Sowden, Senior Science Officer in the same Science and Technology Department in London. He was previously Science Officer in Egypt, Spain and Turkey. If I may go back to your notion of the Council as a lubricant, yes, I think I would accept that role. I might argue for "catalyst", but it would have a similar effect. "Lubricant" might imply that we were simply a funding agent and I think we are a little more than that. In the context of this Committee's inquiry, which as I see it is about great

international oaks, we are in fact a planter of acorns, and an important one. We are the Government's principal agency for the promotion of cultural with other countries. We do have a fair amount of expertise and have seed boxes in 90 of those countries. Whatever the Council does, it is as it were at the initial stages of creating relationships between scientists and awareness of each other's scientific programmes, but not the determination of research policies.

121. In what way do you make scientists in this country aware of scientific programmes going on in other countries of which they would not be aware through the normal contacts of their disciplines?

(*Sir Richard Francis*) If I were to say that that was a secondary benefit and not a primary purpose, I think it might clarify it. We do use science and technology and scientists; we use it and use them in the sense we use it as a weapon and tool to pursue the objective of securing a better understanding in other countries of Britain, its science, its creativity and its research. We are primarily outward in our intentions. To achieve that objective not only do we bring scientists from other countries to this country, as a predominant proportion of the exchanges, but we also send a lot of British scientists to other countries as consultants, and so on. In particular, increasingly we are seeking to create scientific, academic research links between scientists of this country and appropriate mates in other countries. In that sense, we act as a marriage broker. We retire once they get on well enough together. They can have the children but we do the introductions, and we may even pay for the wedding. We will actually

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[Continued

[Chairman *Contd*]

put some money in at that stage, but it is pump-priming money; it is not the sort of money which supports research programmes as such.

Lord Nelson of Stafford

122. Is there not a follow-up operation here which could be rather important. Bearing in mind you have residential scientific officers, should you not ensure that we are getting the maximum out of these international collaborative agreements, particularly in relation to the exchange of personnel who have long on-going associations. Experts in diverse fields would be working together and establishing a relationship which would continue in the years ahead. It has been said that nobody takes care of this particular situation to make sure we are getting the maximum out of these opportunities for international co-operation through these international programmes. Is there a role here for you beyond simple pump-priming? Is there a follow-up role?

(*Sir Richard Francis*) There is indeed a follow-up role, and I would not wish to leave the impression that our job ends with the pump-priming. In the first instance, not least using the network of our science officers and science-qualified officers, we need to identify the best and most appropriate partners, and in that sense knowledge of the scientific scene in the different countries where we operate is an essential ingredient, not merely knowledge of the scene as if it were static but following the trends, which can be really fast-moving, and monitoring how the links are developing. For instance, we are particularly conscious of the way in which as a matter of government policy the Korean Government has determined to put a lot more money into creating links with the European Community. Britain finds itself at a disadvantage in comparison with France and Germany because of lack of investment in that work in earlier years. To give a negative example to illustrate the point, we find if there is something missing we get a much smaller proportion than those other two countries of the science-linked work.

Lord Kirkwood

123. To go back right to the beginning, you talked of planting acorns. At that stage, are you proactive or reactive? Do you go out and seek to talk to people, or do people come and talk to you at that stage?

(*Sir Richard Francis*) We are proactive within specific areas; we are proactive in seeking to promote exchanges, and that will involve the selection of people to take up available scholarships, traineeships and so on. We are proactive in seeking partners, particularly partners who are going to be prepared to put in funding, or be involved in joint funding; and we are also proactive in providing information about the British scene. Increasingly, we are using our libraries overseas, which are not only stocked with books but with audio and video material, databases and so on, to gear those people who are

specifically our target clientele to the kind of information they seek. Forgive me if I have explained that badly. We go to our clientele and say to them, "What kind of information do you need from Britain? Which periodical or scientific or medical journal do you want?" We have a proactive policy now in our libraries; we are not simply putting on shelves things which we think might interest people who might come through the door.

Chairman

124. You are not working to any priorities laid down by the Foreign Office; you choose your own?

(*Sir Richard Francis*) Yes and no. If that is not an unsatisfactory answer. I will deal with the way in which we are acting in parallel with Foreign Office policies in terms of priorities accorded to different countries and different regions. We are very much in parallel with the Foreign Office who are our principal sponsoring department; the ODA is our secondary sponsoring department. What we are doing in the developing world, for instance, is either to administer programmes according to policies of the ODA for the ODA in the field of technical co-operation and so on, or, with our own core grant, we are complementing those programmes. Thus, if there are subject-areas which do not fall within their key sectors we will seek to cover those with some of our own money, or money derived from other sources, such as international agencies or indeed the clients themselves. Quite a lot of the work we do is country-funded or client-funded training, led by the demand in those countries. In that answer I think I have begun to suggest it is not simply Foreign Office policy we are responding to, though we are certainly acting in parallel with that. We certainly do respond to ODA policy where we administer work on their behalf, but at the same time we are operating independently, determining policies which are very largely demand-led by the client countries and client institutions in the countries in which we work.

Lord Sherfield

125. We talked previously about the Whitehall machinery which deals with this area of policy. We know we are not allowed to know about it, but some of us have a shrewd idea of what it is.

(*Sir Richard Francis*) We are allowed to know even less!

126. Are you an integral part of that machinery; in other words, do you have a seat at the table?

(*Dr Richards*) Perhaps I might answer that question, having been somewhat involved in the machinery itself. I can assure you that we are very much involved in that machinery, but we are not allowed to talk about it.

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DR JUNE ROLLINSON and DR ROBIN SOWDEN

[Continued

Lord Nelson of Stafford

127. Does the British Council regard it as part of its duty to play any part in the question of the environmental issues which are now becoming very prominent, particularly in developing countries?

(*Sir Richard Francis*) Yes. We are presently conducting a survey of all the work we are doing in connection with environmental studies, and it is quite considerable already. We are conducting that survey as a precursor to developing an environmental programme policy for the Council, which will be discussed, as are all our main policy programmes, with our sponsoring departments, the FCO and ODA, the permanent secretaries of which are members of our Board. On a regular basis they are fed with paper and are party to Council policies.

Chairman

128. Before you finance an exchange or a fellowship or put money into any of these activities, how do you make the decision as to whether or not it is worth doing and whether the quality of the person concerned and the quality of the science he intends to pursue is worth putting your money into?

(*Sir Richard Francis*) That decision is not taken by any one person or any one part of the Council. Essentially, in each country it will be the responsibility of the representative, assisted by the science officer, to come to decisions as to the priorities in that country and as to the viability of proposals and as to the capability of the would-be recipients. But we are guided by four advisory committees, such that although we have under Dr Richards a department which includes 12 science officers,¹ they are guided in their work by four advisory committees comprising a wide range of expertise from the world of academia, science research and so on.

(*Dr Richards*) To take the example of our work in Japan in terms of how we select our scholars, we have been sending people to the United Kingdom since the early 1950s. There, we simply appoint a local specialist committee which draws on people we know and trust. Generally, these are people who themselves have direct scientific experience of working in the United Kingdom. These are fairly eminent individuals. Our medical adviser was the Principal of Tokyo University. There are other examples of such people who have assisted us on those committees. They will provide the peer review system, if you like, which would normally be part of the operation in the United Kingdom. In terms of the rather larger programmes which we have initiated more recently in Europe, on the British side we have a two-tier means of assessing how programmes are going forward. We have a major

collaborative research programme by the name of ARC in Germany partly funded by the British Council and partly by its German counterpart. In such a case, both sides of the divide conduct peer reviews of the proposals received. In the case of the British side, we draw heavily on the research council mechanisms for reviewing projects, and we then put forward proposals for final selection with the assessment of specialists in the particular field which the programme addresses. Those go forward to a specialist committee, again drawn from eminent people on the British side and the German side, and armed with the two views that committee decides on the priorities.

Lord Nelson of Stafford

129. What are the specific programmes to which you are referring?

(*Dr Richards*) These are programmes that the Council has been running in Western Europe.

130. On a collaborative basis?

(*Dr Richards*) Yes. The funding for these programmes is provided by the British Council and the counterpart organisation, which in France is the Ministry of Foreign Affairs, in Germany it is the Academic Exchange Organisation—DAAD—in Spain it is the Ministry of Education and in Italy for new programmes it is the Ministry for Universities, Research, Science and Technology. The funding, which is quite considerable—it is not only the British Council's contribution but also matching contributions from the other side—goes to support research collaboration by providing mechanisms to deal with the exchange activities. The researchers involved in these programmes bring their existing research funds in a sense to the table; they are drawing on research funds that they have already been awarded nationally.

131. What sorts of programmes are they? Can you give examples?

(*Dr Richards*) They are all academic research programmes. Sometimes, they involve the research councils' institutes, but they are predominantly research programmes between higher education institutions in both countries.

132. On specific scientific subjects?

(*Dr Richards*) Yes.

Lord Kirkwood

133. They have already had the research funding; it has already been assessed, so you are reassessing something which is going on?

(*Dr Richards*) Yes, but it is nevertheless a process of selection. Dr Rollinson can perhaps give the figures, but I understand that in the first year of the ALLIANCE programme in France the demand was

¹ *Note by the witness:* In addition, the Council has a further 4 Medical advisory staff, conducting a similar role for the medical and paramedical subjects.

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[Continued]

[Lord Kirkwood *Contd*]

five times the available money to fund the programme. There had to be some form of selection mechanism, and peer review is still the best way of doing it.

Lord Sherfield

134. Of the 12 scientists on your staff, am I right in thinking that some are resident abroad, or are all at home and you have scientific officers overseas?

(*Dr Richards*) We have staff both within our headquarters and overseas, that is, London-appointed staff. They amount to 14 people who are distributed around the world in 12 countries. They are supported by locally-engaged staff who are often extremely well qualified. For example, the staff in India are excellent.

Lord Nelson of Stafford

135. They are nationals?

(*Dr Richards*) Yes.

(*Sir Richard Francis*) They are liable to be PhDs themselves and well in touch with their own science scene.

(*Dr Richards*) Whilst the London-appointed staff move around the world, these locally engaged staff provide a good deal of continuity and develop expertise which London-appointed staff could not be expected to duplicate.

Chairman

136. You must be in a very good position to take an overall view of how successful is British participation in international scientific activity both as seen from the point of view of scientists of this country who are taking part in it and what other people think about it. Would you like to comment on both those aspects? Do you think the record is good and that the scientists involved are satisfied and everybody is happy with the system, or are they unhappy?

(*Sir Richard Francis*) If the proof of the pudding is returning to the restaurant, then they have been highly successful. What we have discovered by dint of having a bit more government grant is that we have been able to launch the Academic Research Collaboration programmes in Germany and France, and the demand has far exceeded our expectation and those of our colleagues on the British side. If that be evidence, it is evidence of an unmet appetite.

137. I am not just referring to those schemes. You very often provide funds for scientists to go overseas in order to discuss with fellow scientists whether or not to set up a collaboration, so you must get an overview of the whole field. Do you think the picture is rosy, or do you think there are impediments which could be cleared out of the way to improve matters?

(*Sir Richard Francis*) To give one quick answer and then defer to my science colleagues, I have

visited 117 of the Council's offices around the world in the last three years. There is not one I can recall where we are yet meeting the demand for British scientific and technological know-how. I am not a scientist, but I am talking in those terms. There is a major appetite not merely for our science but for the language of our science. It is relevant that we teach and research in English, but equally it is not simply that which creates the demand; it is the regard for the quality of the work which is available if you co-operate with British partners. I would like to defer to Dr Rollinson who has been involved in France recently.

(*Dr Rollinson*) In France, the demand is to set up or bid for one of the many European projects, and Britain is a very much sought-after partner, partly because we have proved very successful in applying for European projects, be they joint programmes like ERASMUS and COMETT or the Framework or special programmes like EUREKA, BRITE or FLAIR. There is an enormous demand for British science. There is no doubt that the kind of exchanges work being ironed out problems and facilitates the kind of discussions required before committing oneself for a very long time to the provision of laboratory space and the other elements that collaboration entails.

Lord Adrian

138. May I say that I was a practising scientist and over many years I found that my chief interaction with the British Council was an enormously valuable service in terms of the Council being prepared to respond to, let us say, a letter saying, "Look, I am going to *this* country. Can you tell me whom I should be able to see there in my own particular field?" The information provided has been enormously helpful, and a very great deal has developed from it. I think that what you have just been talking about in terms of facilitating the ability to apply for international or European research grants is another development, but over 25 or 30 years what has emerged has always been the ability to know that if you are going to a particular country you will know your way about with the right people there. That is a valuable service.

(*Dr Sowden*) My Lord Chairman, as evidence that in fact this work is of value, I would like to mention that we receive innumerable letters of appreciation from individuals who have been able to take advantage of the Council's services. On a larger scale, the British Council is frequently invited to bid for paid contracts involving education services on the basis of its track record on a small scale.

(*Sir Richard Francis*) I endorse that. In that case, we are not in it for ourselves; all we are seeking to do is put together the best possible package of British resources, and where international competitive tender is the requirement, as frequently it is, as with the World Bank, what we are doing is competing against the best the Germans, Japanese, Americans and others can offer. Our role is to act as broker or

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[Continued]

[Lord Adrian Contd]

organisation to package the best possible British bid. We have given evidence of some of the effects of that in Turkey. A huge amount of work has been won for Britain on the basis of winning two large paid education service contracts.

Chairman

139. Is language still a major factor?

(*Sir Richard Francis*) Yes, and it does have its advantages as far as we are concerned. In some cases, we find that people who are scientifically eminent have that eminence somewhat diminished, not because they do not speak English but because their English is only 80%. In many of its teaching centres overseas the Council will not merely test their English but bring them up to a high professional level prior to departure for the United Kingdom, or prior to participation in one of these joint programmes. That has a funding connotation because sometimes it may be quite difficult to find the funds for that, even though you can find funds for the main work.

Lord Kirkwood

140. I am wondering whether you monitor the success of your exchange programmes in developing into more permanent international collaboration. Do you do it as a matter of routine, and do you know what success comes out of it?

(*Sir Richard Francis*) We do it as a matter of routine. I have to say that our approach is to target the successor generation, and that kind of measure of success comes quite a long way down the line, in much the same way that it might be difficult to distinguish between the positive contribution made by an exchange at a very early stage of somebody's academic life and what subsequently grows to be very much bigger—the oak. It is quite difficult to determine the criteria by which to gauge that sort of measure.

(*Dr Richards*) Drawing on experience in Japan, I mentioned that the British Council had been running a scholarship programme in that country since 1953. The people who have taken part in that programme in the early days are predominantly scientists. By the time I was in Japan these people occupied very senior positions. It is perhaps exceptional, but I do not think particularly exceptional, that in Japan people were very interested in their early affiliation in terms of paying it back with some gratitude for the help they had received in their early years. I can quote from a number of examples. One individual had gone through the process of being dean of engineering at Tokyo University where he had established links with his old college, University College London, for an exchange of engineering students. He then went on to become Director General of Japan Society for the Promotion of Sciences, which is the Ministry of Education's main vehicle for supporting scientific exchange, whereupon he formed a fellowship programme with the Royal Society which has benefited the UK. I think

the UK has benefited considerably from his two years at University College London in the early fifties. There are numerous other examples of that type of success. In terms of other early contacts, again looking at Japan, some of the collaborative programmes in which we were involved in the late seventies have led through into the programmes of collaboration which are now supported by the Science and Engineering Research Council, and they have led to major international collaborations involving major facilities both in the UK and in Japan.

Lord Nelson of Stafford

141. One has the impression that overseas organisations take advantage of the international programmes to have their scientists trained in the foreign languages concerned, and this is done deliberately. Does the converse hold? Are you taking advantage of international programmes to get our people equally well trained in overseas languages?

(*Dr Richards*) As an individual who finished off a research career in France—not on a British Government but a French Government programme—I was able to learn French at that time and raise my standard well above school level French. I think that has been very beneficial to me in my career since. One has to recognise that in countries like Japan where the language has a particular difficulty, it can be a barrier, and it can be particularly demanding for people who are going to be there for perhaps a year or less.

142. The Japanese see that barrier and take special steps to overcome it; they do not see it simply as a barrier which is there.

(*Dr Richards*) My experience of the younger research workers, particularly those who are not married and enter very fully into life in research laboratories in Japan, is that within nine months to a year they can become quite competent linguists, if only at an oral level. Japanese is a particularly difficult language.

143. I am still worried that we do not take as much advantage of these international programmes as we might in improving the language abilities of our young scientists.

(*Dr Rollinson*) To comment on that, the large international science programmes usually have designated official languages, and there our scientists are not at a disadvantage because English is normally one of those languages.

144. That does worry me. Should it be French?

(*Dr Rollinson*) I was going on to say that in France there is a great deal of debate on languages. The French are now considering that in relation to the training of their own engineers they should have a minimum of two other, if not three, obligatory

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[Continued

[Lord Nelson of Stafford *Contd*]

languages. Going back to our own education system, we still have the problem of our young engineers going to France. Although French is the most widely taught second language in the United Kingdom, our engineers are not generally anywhere near the level to be able to start off or continue a postgraduate qualification within the French *Grande Cole* system, for example.

(*Sir Richard Francis*) My Lord Chairman, it is not the British Council's job to promote the learning of foreign languages; it is within our charter and remit to promote the learning of English, but I do not think you will find amongst my colleagues anyone who will differ with what Dr Rollinson has said. I believe there is a great danger that the British will be complacent—we are complacent to start with—because other people learn our language. If we are

to be fully prepared to benefit from all forms of international collaboration and co-operation, and if indeed we are to take our places in the work places of Europe after 1993, then this country should pay much greater attention to the learning of foreign languages.

Chairman] My impression is that, compared with 20 years ago, and certainly 40 years ago when I worked in France on the military staff, particularly in the scientific field far more French people speak and understand English. I think this poses problems for a young scientist. If he is going to learn another European language, which one is he going to learn—German or French? Thank you very much indeed. Your evidence has been most helpful in keeping our gaze not on the oak but on the acorns.

MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY

(SUB-COMMITTEE II)

Tuesday 17 July 1990

CABINET OFFICE

Sir John Fairclough and Mr Philip Thomas

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TUESDAY 17 JULY 1990

Present:

Adrian, L.	Kirkwood, L.
Carver, L. (Chairman)	Lewis of Newnham, L.
Flowers, L.	Shackleton, L.

Memorandum by the Cabinet Office

**REVIEW OF INTERNATIONAL R&D PROGRAMMES: GUIDELINES FOR FUTURE
INTERNATIONAL COLLABORATION**

ASSESSING THE CASE FOR UK PARTICIPATION

- i. Be clear what the UK's scientific objectives are and the benefits that will flow from successful application of the results.
- ii. Make sure you can define the benefits you expect the UK to enjoy as a result of carrying out the project internationally.
- iii. Make sure that all departments in the UK with an interest are involved and that the UK co-ordinated front matches that of the potential international partners.
- iv. One department should take the lead, backed by clear commitment from others on long-term co-ordination and funding.
- v. Consider the relevant strengths of the UK and potential partners.
- vi. Keep abreast of other relevant negotiations, etc., that are taking place between the UK and potential international partners.
- vii. Don't rule out joining an existing collaboration.

NEGOTIATING TERMS OF PARTICIPATION

- viii. Consider all options to ensure the UK gets value for money.

Major ways of achieving this include:

- a core plus menu approach where members all contribute to the core activity but are free to join and fund optional programmes.
 - by relating the method of calculating subscriptions to use made of the facility by members. Where subscriptions are linked to GNP, the most up-to-date figures should be used.
 - minimising the problems of exchange rate fluctuation.
 - expanding membership.
 - getting the host country to pay more.
 - making sure the international organisation charges other users in a business-like way.
 - ensuring the programmes are efficiently managed.
- ix. Ensure there are satisfactory management arrangements and that the UK has clear channels of influence.
 - x. Testable objectives must be agreed at the start. Discrete milestones for assessing progress towards these objectives and for questioning whether initial rationale and assumptions are still valid must also be agreed. There must also be exit points where one or more members can leave without penalty.
 - xi. Ensure that the budget is realistic and anticipates expenditure needed to keep the facility or programme up to date.
 - xii. Consider the pros and cons of juste retour for industrial contracts.
 - xiii. Consider the pros and cons of juste retour for allocation of facility use.
 - xiv. Adopt a business-like approach to intellectual property.
 - xv. Take care with treaties.

MONITORING THE PROGRAMME

- xvi. Make sure that there is effective monitoring within the organisation but also carry out independent UK monitoring.
- xvii. Ensure priorities for international work are regularly assessed alongside domestic ones.
- xviii. Satisfy yourself that the UK community is benefiting fully.
- xix. Promote effective arrangements for public presentation of the collaboration in the UK.

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[Continued]

LEARNING FROM EXPERIENCE

- xx. Ensure that the international organisation carries out an evaluation of performance both against scientific and management objectives.
- xxii. Carry out an independent evaluation on the benefits to the UK.
- xxii. Share your experiences widely within the UK.

Examination of Witnesses

SIR JOHN FAIRCLOUGH, Chief Scientific Adviser; MR ROY WALKER, Under-Secretary, and MR PHILIP THOMAS, Assistant Secretary, Cabinet Office, called in and examined.

Chairman

145. Sir John, we are most grateful to you and your colleagues for coming and giving evidence to us today. We are most grateful also to Mr Walker for having sent us the Guidelines for Future International Collaboration. The reason why we started on this study was that it was said to us that the situation was not very satisfactory, particularly in the case of proposals for international scientific programmes coming from outside the country: that an awful lot of different people were involved, and the machinery for seeing that everybody who *might* be interested played a part in deciding whether or not to take part and then, perhaps equally important, continued to support the programmes afterwards was not altogether that satisfactory. So perhaps you would like to start by explaining what the machinery is and whether you think it *is* satisfactory?

(*Sir John Fairclough*) Thank you, my Lord Chairman. Perhaps I could start by introducing my colleagues. Roy Walker sent you the guidelines that we produced. Roy Walker is (to use a European description) my *chef de cabinet*. He succeeded Vivian Brown whom some of you may remember. Philip Thomas is responsible for running our International Secretariat, and is one of three groups within the Science and Technology Secretariat: the others are, first, the ACOST Secretariat, and, secondly the Domestic and Assessment Office. I really do welcome the opportunity to speak about this increasingly important subject. My remit, as you know, is to co-ordinate our international activities in science. That is spelled out in Command 185, the Government's response to your earlier Report on Civil R & D. That involves me in a number of activities the centre of gravity of which revolves around collaborative European research and development where Philip Thomas takes on the major work. I am a member of CREST, the Committee on Research, Science and Technology. That committee has responsibility for advising the Ministers, at Council of Ministers meetings, on science proposals from the Commission. Mr Thomas engaged in a number of meetings ensuring that our response to the last Framework proposal was properly co-ordinated. I will speak more about that in a few moments. I am also a member of the Board of Governors of the Joint Research Centre. Your Lordships will know that there are four laboratories wholly financed by, or mostly financed by, the EEC, collectively known as the Joint Research Centre. I am a member of the Board of

Governors of that, as I say. A considerable amount of money is devoted to that centrally-managed research—950 million ecu over a four-year period (1988-91). We have been very unhappy with the scientific and technical vitality, shall we say, of those laboratories, particularly the laboratory in Ispra in Italy. The Board of Governors has been very proactive in trying to change that, by introducing new policies to ensure that more younger people are recruited, that 100 of the existing tenured researchers take early retirement, that they earn more of their income through contracts with third parties and from other directorates within the EEC, rather than just DG XIX, etcetera. We could talk more about that, if that were a subject of interest.

If I could say a few words about the last Framework Programme, negotiations on the Second Framework Programme were just beginning when I took office in 1986. The lesson I learned from that rather difficult experience was not to become involved in finances too early but to focus attention on the content. This last year, in the run-up to the negotiations for the Third Framework, we concentrated wholly on content both within Whitehall—to ensure that departments focussed *their* attention on content and were satisfied with what was being proposed—and within the Commission to make substantial changes to the initial proposals to be more consistent with what would suit us. We focussed all our attention in that way in the early stages, and only in the last week or so running up to the final meeting did we discuss and co-ordinate the financing of it. I think the outcome was wholly satisfactory. It was not as large as the Commission wished—7.7 billion ecu was their desire, and it was settled at 5.7 billion ecu—but it is still a significant growth on the existing framework and, I think, serves our interests quite well. Philip Thomas is largely responsible for those successful negotiations, and he really did a first-class job in co-ordinating that activity.

146. If you take the next Framework Programme, are we all ready?

(*Sir John Fairclough*) It is a little early. One of the aspects of the agreement was to move towards a rolling programme in which we will agree the extension of the existing framework every three years. The specific arrangements for the rolling arrangements have yet to be agreed, but in concept it is that we would add two years in the middle of the currently operating Framework Programme, so that there would be a rolling extension, and involve a review of what had been accomplished and the

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SIR JOHN FAIRCLOUGH
and MR PHILIP THOMAS

[Continued

[Chairman *Contd*]

arrangements that had been established, to ensure there was consistency, if you like, with the decisions taken in the middle of the programme. At the same time Ministers would put their hand on the tiller and make some adjustments, whatever would be appropriate, for the remaining half of the existing programme, but then extend it over two or three more years. Could you be more precise, Philip, as to the details of the rolling programme? The details of the rolling programme are not yet finalised, are they?

(*Mr Thomas*) That is right, except that, as Sir John Fairclough explained, my Lord Chairman, there is now going to be a series of interlocking five-year programmes, and we are effectively on a cycle of $2\frac{1}{2}$ —3 years at the end of which you would have a review and agree the next five-year programme. As Sir John has explained, this *does* allow both flexibility in changing and adjusting the objectives of research and, of course, agreeing new finances for the outer years of the new Framework Programme as well as evaluating what you have done already.

So to answer your original question, no, we have not yet started addressing the next Framework programme, because the specific programmes of the 1990-94 Framework Programme have not yet been put in place and we therefore have not had a chance to evaluate how the work is going to go over the next two or three years. We are still evaluating the work that is being done under the Second Framework Programme which comes to an end at the end of 1991.

(*Sir John Fairclough*) Before we move on to that level of detail, could I add one more point to my opening remarks, Lord Chairman? It is really picking up the point you made. I think the character, as you will know, of the collaborative research in which we engage covers individual, bilateral arrangements between scientists, very heavily driven by their own efforts. Science is increasingly international in character and ranges from small to large-scale projects. We respond to proposals put to us and, if I could make one comment that ties into your opening remarks, I think we rely very heavily on a "bottom up" approach to our collaboration, driven primarily by the scientists—and it is right and proper, that a wider and larger number of people are involved. I would not wish us to move to a managed situation driven from the top down. I think encouraging the scientific community to be the initiators is the right basis on which we do international collaboration on science. But I accept that this cannot always be. Because of Framework and other large programmes there is a need to have a broader policy judgment. So one is looking for a marriage between the interests of the scientific community and the broad goals serving our national requirements. By the very nature of things, I cannot see any arrangement that would reduce the number of people involved and make it a focal point without destroying the "bottom up" character of the activity, and I would urge not to move in that direction. One last point, Lord Chairman: we respond, I think,

quite effectively to proposals put to us. But I would like us more often to be seen to be the initiators from the bottom up from the scientific community of international proposals. The opportunity to have a large-scale international collaboration does not happen very often, but when it does it is usually from another country playing the lead, and from time to time it would be nice if we were playing the lead.

Chairman] Can you suggest how that might be brought about?

Lord Flowers

147. European synchrotron radiation?

(*Sir John Fairclough*) Yes, the ESRF.

148. That was British.

(*Sir John Fairclough*) The technical work started at Daresbury. We played a leading role in that. The Human Frontiers Programme comes to mind. My reaction when I first heard the Japanese proposals for new human frontiers was "Why didn't we think of that?"

149. My Lord Chairman, I greatly welcome what Sir John said about the "bottom up" approach. But talking about the changes that had to be introduced to the Framework Programme before it was satisfactory from the British point of view, I think it would greatly help us if Sir John could give an indication of what sort of changes had to be brought about before it was satisfactory and whether other countries saw it as equally satisfactory when we had made the changes we wanted?

(*Sir John Fairclough*) I would say there was a great deal of interaction on all of the proposals, but the major influence that we brought to bear was to focus the Commission's attention on the industrial competitiveness dimension of the proposal, that being one of the primary objectives of the European R & D Programme. The terminology used by the Commission was very much of a product development character, it was not of a research character, it did not sufficiently emphasise the primary role the Commission have—that is, to bring parties together and agree standards for complex technologies and markets before standards exist. I am thinking of broad-band communication, of a lot of the work involved in the information technology section to do with tools and facilities needed to build economy of scale into the European processes which require a focus on standards. That is a role that the Commission uniquely can provide in bringing parties together to agree standards so that we can deploy the economy of scale in Europe and be more effective competitors with Japan and the United States. So we really are very insistent that the Commission change its own goals and objectives to focus more on that aspect and move away from product development. You have to do the sub-product development in order to arrive at good standards; you have to do some prototyping,

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examine a number of options and choose from those demonstrated which is the right and preferred direction, and that is appropriate. But it was the question of how those goals were expressed that caused concern. They should be expressed in terms of the ultimate objective of getting agreed standards rather than developing a product. That is for industry to do not the Commission.

Chairman

150. In the first of your things in the guidelines you tell the prospective collaborator to be clear what are the United Kingdom scientific objectives and benefits that will flow from successful application of the results. How is the prospective collaborator going to judge what the United Kingdom scientific objectives are and how is he going to assess the benefits? Do you help him in that?

(*Sir John Fairclough*) Yes, quite often. These ground rules, Lord Chairman, came out of a review that the Cabinet Office conducted of the number of existing large-scale international projects in which we were participating and what emerged from that review was that scientists really had no general management guidelines under which they could operate, and so these new guidelines were an attempt to give a framework and to have a more consistent approach to the way we participate without imposing our judgment on the scientific merits of what was proposed. Philip Thomas maintains an on-going list of large-scale projects and of any decisions that are anticipated in the next year or so. These are identified and are circulated across Whitehall as a co-ordinating document. He meets with officials from departments as appropriate, and on many of the points included in this document we get an opportunity to advise and counsel and help. Our role is one of co-ordination, not one of initiation. Many of your questions attributed perhaps more responsibility to myself and my office than exists.

Lord Flowers

151. These guidelines refer to the top down part of the plan, not the bottom up part. I wondered at what point it joins up, because these sorts of things would be quite inappropriate to the kind of work that is so often started off with two or three people talking together at a conference or whatever it might be.

(*Sir John Fairclough*) Yes. I am contacted regularly by scientists. It takes the form of a lobby—they would like to do such and such and can I help them? We encourage that.

Lord Shackleton

152. I was very interested in Sir John's last remark that his role is co-ordination rather than initiation or executive. The truth of the matter is, we are very reluctant to experiment constitutionally. The whole concept of the Cabinet Office playing a

role is one that has evolved rather uneasily. I lead up to one particular question. I do not know how far you deal with people like DG XII or any of the European institutions, but I wonder how far, in dealing with both, they recognise you or the Cabinet Office as being a super-authority, a British authority? Do they understand the relationship with government departments? Is this an area of difficulty? It seems, from what you have been talking about, that you manage this without too much friction, but I imagine there will be times when you will be in disagreement with a department.

.....
It does lead on to the suggestion—and perhaps you will reserve that until later—that this Committee did at one time propose that there should be a Minister not exercising the role of the different departmental Ministers but co-ordinating, keeping an eye on, alerting the Cabinet?

(*Sir John Fairclough*) In taking up your first point of our relationship with the Commission, DG XII, DG XIII and our conduct of affairs interfacing with Brussels on the one hand, departments on the other, I think it works quite well.

.....
As for the question of a Minister I would not put myself in a position of trying in any way to pretend I have any such authority, but more often than not I deal with Monsieur Curien, Monsieur Reisenhuber and the Minister of Science in those countries, and I think I have established a rapport with them. Of course, we work with their officials as well and have, I think, good relationships. There have been numbers of times when we have felt it advantageous to get together France, Germany and the UK particularly, sometimes with Italy—at official level, and quite often involving discussions with their Ministers, to share our common view, or not, on proposals that are emanating from the Commission or from other places. We have found that informal contact very useful. In terms of the main part of your question—which is do I find myself at a disadvantage in these relationships?—I do not feel really in a position to make that judgement, to be truthful, because I believe our present arrangements work quite well.

Chairman

153. It has been suggested to me that in fact we are at a disadvantage compared to other countries. First of all, that it takes an awful long time to get a decision from our governmental machinery as to whether we are going to participate in an international programme or not. There is then the financial angle through our system by which the Research Councils get their allotment of money and, with a certain amount of gambling in collusion with the Treasury, they have to cater themselves with the problem of currency fluctuations. Finally, that there is not, as there are in most other European countries

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anyway, a Minister of Science who can deal with the whole thing. Do you think that we *are* at a disadvantage in those respects?

(*Sir John Fairclough*) I think that with the Prime Minister and her interest in science and her commitment to involvement in scientific issues, the Cabinet process in which she is actively involved, her chairmanship of ACOST which has been occurring about twice a year, there *is* the opportunity to have influence right at the top on things that matter.

Lord Shackleton] Could I comment on that. Having had views on the Science Minister, I have always thought that a junior Minister and Science Minister playing this rather vague role would be rather ineffective. Those who are relatively low in the pecking order in Cabinet, as I was, do not carry the weight of, say, the Lord President of the Council, or the Chancellor or somebody like that. I do not know whether the suggestion is that if it were not the Prime Minister herself doing it you would need a very senior Minister.

Chairman

156. You talk about the European Framework Programme. That, of course, is only part even of our European collaboration?

(*Sir John Fairclough*) Yes. My Lord Chairman, I want to make a comment on your remarks a moment ago, and that is as to the currency fluctuations and the point you made about Research Councils. Of course, that applies to science only. Generally those difficulties do not apply to European Framework activities. One has got to make a distinction.

157. No, not to the Framework activities, but from what you have said, you would like to see the Framework activities concentrated on things which are special to what the Commission is responsible for, is that right?

(*Sir John Fairclough*) Yes indeed. I would be very unhappy if the Commission were to broaden its interest in basic science. Through the very nature of the institutions and the way they conduct their affairs, they would introduce a degree of centralised management to the whole process which would not be in the best interests of science.

158. Even for European collaboration?

(*Sir John Fairclough*) Even for European collaboration.

Lord Flowers

159. Could I ask, Sir John, whether, in talking about science in the way you just have, you see European collaboration as something wider than the Community in a significant sense?

(*Sir John Fairclough*) Increasingly so. The EFTA countries are participants in quite a lot of EC specific programmes already, and we have got the emerging and burgeoning opportunity in Eastern Europe.

Lord Kirkwood

160. What is the input of the Research Councils in developing the Framework Programmes, particularly in basic science? Since they apparently are losing themselves funds as a result of some involvement in the European research work, if they have no input then they are being taxed without representation, in a sense.

(*Sir John Fairclough*) First of all, let me comment that whether they lose, as you put it, has yet to be determined.

161. They lose in the sense that they do not decide.

(*Sir John Fairclough*) Yes, in that sense, if they do not participate in the dialogue with the Commission.

The human resources line at 493 mecu is one in which we are quite actively involved in the Commission's proposals. Currently there is a debate there. Vice-President Pandolfi would like to spend more on bursaries and exchange of people and less on collaborative science as such than the scientific community generally would like to see—not just ourselves—so there is a debate going on.

Chairman

162. I referred just now to the question of United Kingdom scientific objectives and the word “benefits” which occurs several times. When we were taking evidence from the Foreign Office the other day we asked them whether there was any Foreign Office policy about preferences as to whom you collaborated with and they said, no, it was entirely a matter of judgment on scientific grounds. Do you consider that there is or should be some United Kingdom policy, for instance, that you should first look to Europe to collaborate before you look outside Europe with America, Japan or even the Soviet Union—we are not counting them in Europe for that? What we have not yet been able to get any sort of feeling about is whether anybody thinks it is to the benefit of this country to base international scientific programmes here both because that provides this country with facilities which are attractive to our own research scientists which we otherwise might not be able to afford and because there are a number of other benefits that flow from it. Neither in talking to the Treasury nor in talking to the Foreign Office did we get any sort of line on this at all. They maintain pure science decides everything.

(*Sir John Fairclough*) I think it is dangerous to generalise, but let me try! On the one hand, if one is concerned with basic science, then I think it is a question of sowing seeds and letting a thousand flowers bloom, and one ought not to have set limits. But of course our scientific community would naturally be led to work with centres of scientific excellence—the United States, Germany, France etc. So I think the normal processes through which that collaboration is operated serve our interests quite

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well. When you come to strategic science and concern for ultimate exploitation that would take on a broader economic character. Then I think you have to build preferences into those relationships. I myself chose to focus on Japan, Germany and France. One of the problems in interfacing to Europe, is that we have been far too focused on the Commission programmes and orienting our thinking around the Commission programmes and have not sufficiently developed our bilateral relationships. The scientific community probably have not had those inhibitions because they have been progressing through developing relationships across centres of excellence, but other relationships I think have not been developed as rapidly and as extensively as they might of a bilateral nature with Japan, Germany and France. A lot of collaboration goes on with the United States and I did not feel that needed a particular push. We have started a series of round tables with the Japanese: the first last year in the United Kingdom. It was a meeting of officials to examine the present status of collaboration between the United Kingdom and Japan and we involved all the Research Councils in the agenda and dialogues. As a result of that work, three or four quite significant projects have been established. It is the Japanese turn next to reciprocate, probably in the first quarter of next year. We have also established a round table with the Germans: the first meeting is coming up in September with the same objective. I visited France this year, just as Jean Audouze, President Mitterand's Science Adviser has visited here, with the objective of building and strengthening bilateral collaboration with France. The French are keen, the Germans are keen, and we are keen. We need to give much more attention to developing those relationships.

163. But in some of the evidence we have been given people have talked about the need for Europe to compete with the United States and Japan—although I was brought up to think science was a free-for-all for everybody and not a matter of competition but a matter of expansion of knowledge. But do you look at the European programmes in the light of building up a scientific capability and facilities in Europe to compete with Japan and the United States?

(Sir John Fairclough) In some respect, yes. When one talks about strategic science, the very description implies you are doing it for reasons of exploitation and, therefore, you are concerned with the earlier exploitation of a new idea for your economic benefit.

164. Not just to prevent your scientists from "brain-draining" across the Atlantic?

(Sir John Fairclough) Of course, that is always a factor, whether the science is of a curiosity or a strategic nature.

165. From what you said earlier in your remarks about Ispra, it would appear that you would not favour one way of doing that much in establishments, as it were, of European laboratories like EMBO rather than concentrating on collaboration between existing nations?

(Sir John Fairclough) No, I would not. I think there is a role for centrally-managed laboratories and it ought to be carefully identified and the scope of their activities limited to serve that purpose. That role is where there is a benefit in having an independent impartial view on such things as safety—nuclear safety, safety of large chemical processes etc.

Lord Adrian

166. So that you would prefer as a model for the basic science end of things something like the Human Frontiers Programme rather than the major international laboratories set up in particular places?

(Sir John Fairclough) For the Joint Research Centre?

167. Yes. I take your point about the very specific impartial purposes.

(Sir John Fairclough) And measurement, of course, and standards.

168. You were enthusiastic about the Human Sciences Frontier programme a moment ago. I was wondering whether that extended to preferring it as a model for international collaboration in basic science to the EMBO model.

(Sir John Fairclough) No, my enthusiasm for Human Frontiers is really born out of the burgeoning science in that field and the rate at which progress is being made and the opportunity to share experiences more effectively in the biology community. My observations would be that the biology community has not developed international relationships in the same way as particle physicists have, and a focal point that provided the role of catalyst was a good thing to do.

Lord Flowers

169. Could I ask you, *however informally*, which European institutions such as, say, EMBO or whatever, have worked, and which, in your opinion, really have not?

(Sir John Fairclough) I think CERN has worked. I think ILL is an outstandingly good case. I think ISIS at Rutherford Appleton is now working very well as an international centre, though not proposed initially as such.

170. EMBL?

(Sir John Fairclough) I have not been there, so I cannot give you a first-hand view. By repute, it is working very well.

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171. I wondered whether you had a slightly jaundiced attitude towards some groups of European laboratories and institutions which made you sceptical about the way it was done?

(Sir John Fairclough) Only the JRC.

172. We all share that!

(Sir John Fairclough) But I would couch that in positive and constructive terms that they are now making great strides to change. JET I think has done remarkably well: it is a very good place. It suffers in the sense that that it is neither science in the curiosity sense on the one hand, nor is it economically driven on the other, because the prospect of energy from fusion is so far away, and it intellectually falls between these two stools.

Chairman

173. It has met your criteria of meeting the UK's scientific objectives and bringing benefit?

(Sir John Fairclough) At the end of the day great benefits have arisen.

Lord Shackleton

174. Could I turn back to Mr Thomas's remark about your approach to a new Framework Programme? This would not be a group purely of your staff, it would involve presumably various departments. I wonder, is there any description one can have of the people who are involved in this? That leads me on to the further point, would the same people or other people be responsible for assessing the results of this? One of the responsibilities which this Committee welcomed, which was put on you, was to have a staff for assessing results. I do not know whether that is quite right. Would you care to comment on both those aspects and see whether they come together at any stage?

(Sir John Fairclough) The Assessment Office is a separate function from Mr Thomas's activities. They have been primarily focussing their efforts on internal projects and encouraging the introduction of better practice in assessment activities within departments. My Secretariat did, as I indicated earlier, review the large-scale international collaborative projects to look at the overall process. When it comes to the assessment of individual projects, that is very much up to departments themselves. Only if there is a major issue within a department would we become involved. Or, more often than not, these projects serve the interests of more than one department, in which case that gives us an opportunity of examining progress and being involved in the assessment.

Lord Flowers

177. I would like to get a slightly clearer view of how decisions get handed from the research council level to the government level in international circumstances. The case I have in mind is the European synchrotron radiation project which I happen to have been involved with right at the beginning. It started with a casual conversation in a university, and got into the European Science Foundation framework quite quickly—very quickly indeed. It turned out that there were about 200 people practising this art across Europe, they all got together and formed a European Community of their own which had not existed before, with journals and all sorts of things, and none of that required anything other than research council benevolence and tiny bits of money, people co-operating. Then they got their proposals for this new large machine and that was handled in the first instance by the European Science Foundation but with the research councils themselves coming in more and more until the stage was reached at which one knew what one wanted to do and the questions were where, when, by whom and how much and who paid all that?

178. Then governments came in, politics came in, many years went by and nothing happened. It is that period of which I am ignorant, it is that period in which Sir John or his predecessors were involved. I would very much like to know the sort of thing that then goes on when the research councils have said "This is something we want to do" and the Government simply cannot get their collective act together to do it. Do you think that I describe it unfairly? Is this just life as life is, or could it have been handled better?

(Sir John Fairclough) I am sure Lord Flowers would not wish the initial process to be any different.

179. Indeed not.

(Sir John Fairclough) The concern is really about the decision-making process, on where and when, and the commitment of the on-going resources to ensure that a share of national finances will be provided. Philip, can you think of a modern example?

(Mr Thomas) Not quite of that scale, I do not think. All I would say is that I think historically there has been a long gestation period for large international collaborations. The siting of major telescopes for example, is always going to involve a long debate. The development of a new Hadron collider or the internationalisation of the SSC in the United States—all these tend to take upwards of half a decade.

180. Those are an order of magnitude bigger than what I was talking about.

(Mr Thomas) I agree.

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[Lord Flowers *Contd*]

(*Sir John Fairclough*) There is a current example and the gestation has been very similar to ESRF. There is a desire to have a very powerful European laser to be used primarily to produce very short X-ray pulses—a very powerful laser, 200 kilojoules. That has not presently surfaced yet formally as a project that governments have been invited to consider, but it will. In terms of the frustration implied in your question of why can we not make those final decisions more easily and readily, I have no wisdom to offer. I am afraid they will always be difficult and each country will be competing with the other to be the host and there will be kudos to be attained by the country who wins and by its very nature that is political.

Lord Adrian

181. Do you think we compete strongly enough to win these battles that you are talking about, in particular in getting these projects in the United Kingdom?

(*Sir John Fairclough*) If we stay with the later example, there is no doubt that the SERC would like to see that here. Whether they would be brave enough to make that proposal—and by “brave enough” I mean that we are the only country that forces the financial discipline of considering national versus international projects from the same pot of money. They will have to think very hard about making the bid for the facility to be here because there is undoubtedly a premium cost to the country that wins, but it is too early to say.

Chairman

182. You take the view, do you, on the whole—other than a purely Treasury financial calculation of the thing—that it is to the advantage of this country to have things based here?

(*Sir John Fairclough*) Oh, yes, of course, but not in all cases.

183. We have talked about how our own programmes and how the European programmes are run but we have not said much about other things like Eureka, for instance. An area with which this Sub-Committee was closely involved is the greenhouse effect. The Intergovernmental Panel on Climatic Change has done the initial work with three studies. Do you see that being an effective international programme in the future for continuing the work that is required in that field?

(*Sir John Fairclough*) I think so. Specifically with regard to the greenhouse effect and the role of those Intergovernmental Panels, I think that is working quite well.

184. You think that machinery, under the auspices of the ICSU and the World Meteorological Organisation will be effective machinery?

(*Sir John Fairclough*) I think so. We have embarked, as you know, on a major project of

climate modelling. I hope that that produces some of the answers which we are looking for. It is right, I think, to have competition in scientific terms. There are four or five centres doing climate modelling, all of which need to share the same data from a growing number of sources. But to think one would coalesce them into a single international centre would not serve our interests. There is so much uncertainty, so much unknown about the mechanisms that influence the climate that I think it is right to have a number of centres pursuing the same goals. What we ought to ensure, however, is that we do not duplicate efforts to collect all the environmental measurements that they will need to support their work. That needs to be a common foundation.

185. You mentioned before that you encouraged collaboration with France, Germany and Japan. What really do you see as the advantages or disadvantages, the snags or advantages, of collaboration with Japan?

(*Sir John Fairclough*) My view rather takes the form of “You are damned if you do and you are damned if you don’t”. A lot of research work which we would be quite content to put an academic label on and say “That is appropriate and valuable work for universities to engage in” is done in industry in Japan, particularly in the physical sciences, solid state physics and electronics fields. Having collaboration just between academics in Japan and the United Kingdom would not wholly serve our requirements. I think it is necessary for us to be more broadly engaged and have both academic and industrial collaboration with Japanese industry, and their central research laboratories.

There already is a great deal of Japanese investment by companies in Europe, in the UK in particular. I would wish to see every encouragement given to Japanese companies when they are considering inward investments to establish R & D programmes and facilities here. It is from R & D that a broader participation by our industry and our economy would develop. It will take longer, but products developed here for worldwide sale by Japanese companies would involve suppliers from the UK and would provide sharing of experiences. A lot of their manufacturing skill and know-how would be transferred to suppliers. It would all be much more productive. I think there is a sign that more and more research is being done by the Japanese in Europe and in the UK, but I would like to see more of it. Industrial contacts with Japan in Japan could I think lead to more. I would particularly like to see more joint ventures developed between British companies and Japanese companies, perhaps as a precursor to a broader Japanese participation in the European economy.

186. You would not interpret it as just an effort to come and pick our brains and then exploit it to the benefit of their own economy?

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(*Sir John Fairclough*) A growing number of Japanese companies are supporting our university research.

.....
Lord Flowers

187. I would agree, my Lord Chairman. I just wonder, though, with regard to the sort of basic research that in this country or in the US goes on in universities, and goes on in industry in Japan—a good thing in its way—does it there go on with the same sort of intellectual freedom that it does here?

(*Sir John Fairclough*) It is all highly competitive. I visited 14 central research laboratories in Japan 18 months ago as part of a visit to examine the status of opto-electronics. I took eight or nine British industrialists and academics with me. Opto-electronics being an emerging field, I saw the opportunity perhaps to build some relationships that would be meaningful both in science as well as industry. One of the observations you make after you have visited four or five of these laboratories is how similar is the work they do and how similar is the approach that they are taking in pursuit of that work. When you visit laboratories in Europe you expect to see—and they are proud to show—that they have got a unique approach to perhaps 70 or 80 per cent of what they are doing. They believe they can provide some value-added and a different approach. With the Japanese it is the reverse: 70 or 80 per cent of the work they are doing is exactly the same as what you see in the laboratory down the road. They did not know quite often why they were doing a lot of the work, other than that they knew that their competitor was doing it, and if it came up then they could not afford not to have capability and expertise. So their system is very wasteful in economic terms, and one could see greater return from the amount of money that they spend. But that will not happen so long as it is industry doing it.

Chairman

188. We have just mentioned collaboration with the United States, but, of course, one of the disadvantages that is often seen from that is because they do it on such a great scale that they will drive the programme and one will have no opportunity of influencing it a great deal oneself. I suppose you could think of Columbus space station as an example of that. It must be presumably one of the considerations in this choice between the two telescopes.

(*Sir John Fairclough*) I would say generally that that is a subject on which I have made my views clear to the Americans and to the Japanese on more than one occasion. Both of those countries are inclined to consider in great detail programmes for international collaboration, and with considerable debate within the country on what the goals and objectives should be and how they should proceed. Then they surface—the classic case is the American SSC—with the proposal all well thought out and come around

the world suggesting that we might help them pay for it. Similarly, to a lesser extent, with the Japanese and the Human Frontier Science Programme and the their latest project on computer-integrated manufacturing techniques. They really do not have the same ethos as us—and by “us” I mean Europe—of a CERN-like arrangement, an institutional arrangement where they will share their broad goals and objectives, invite participation in the formulation of those goals and objectives (that is the important point) and anticipate institutional arrangements that would make the scientific community (and here we are talking about collaboration in science) feel that they would have a voice in the eventual progress of the project, whatever it was.

189. It sounds very like collaborating with them in the military field!

(*Sir John Fairclough*) Both the Americans and the Japanese, I think, have taken that message on board. I am in no doubt that any future large-scale projects coming from those countries will involve a broader consultation before they surface with a final proposal. I cannot obviously guarantee it, but I hope so.

Lord Lewis of Newnham

190. A number of points were worrying me. Can I go back a long way to the Framework Programme. You are talking now of putting this on to a rolling programme. I am personally very attracted by rolling programmes. However, there is always one problem one has with rolling programmes, and that is that once the thing starts to roll it can be difficult to stop. You were talking also about your assessment of the rolling programme being done, if I understand it correctly, by a different group of people who were initiating the ideas. What I am concerned with is how you are going to do that assessment and how you are going perhaps to redirect new ideas into it, because a rolling programme has an inevitability of going on and on and on if it is successful, but it may not be, when you compare it with other programmes, the most opportune way of expending money. So it is really the relatives of this that I am interested in here.

(*Sir John Fairclough*) I think that one ought to make an important distinction here. The EC Framework is made up of a number of sub-programmes, with goals, which in turn are made up of projects. When we use the description “rolling programme” we do not mean that individual programmes would necessarily be rolling or individual projects would necessarily be rolling, but rather the overall umbrella would be extended halfway through the life of the existing programme. It is an opportunity for Ministers to put their hand on the tiller halfway through the broad programme and make some adjustments: to extend or not to extend existing sub-programmes perhaps to add new sub-programmes. I share whole-heartedly your

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[Continued

[Lord Lewis of Newnham *Contd*]

concern that rolling programmes tend to become self-fulfilling prophecies. Although there is always a danger of that with these European programmes, I do not think the problem is anything like as difficult as your question described, because there is an opportunity to make significant adjustments to the individual parts of the overall programme. What was the second point?

191. Essentially you have got, if I understand correctly, a monitoring programme?

(*Sir John Fairclough*) Assessment, yes. First of all, the Commission is responsible for assessing and evaluating its own programmes through an independent mechanism. We for our part assess our participation in those activities: that would be done by the responsible departments. We will, I am sure, become involved in the Commission's overall assessment and evaluation and participate through UK individuals being invited to join the review teams and at the same time have our own view of what benefits and value we have received from the activity. In short, there two dimensions: first the evaluation of the programme by the Commission for the Commission, reporting to a Council of Ministers meeting, and secondly a review and evaluation of our own participation.

Chairman

192. We have kept you very hard at it for a long time, Sir John. Perhaps I could ask one final question. Can you think of an occasion when there was an international project which you thought was really important but which none of the departments thought was of very high priority, yet you thought from the general point of view it ought to be given higher priority? How was that dealt with?

(*Sir John Fairclough*) I suppose there was environmental monitoring and discussions as to whether we would agree to participate in ESR 2.

Where you need to collect data in order to support a piece of research then the scientific community should pay for that in the first instance. But if the result of their research is such that the continuation of data collection is desirable in a monitoring sense, then that becomes an operational responsibility. It is being performed for monitoring, not for science, even though you could very well be doing science on the data. We have not been very clear about the respective roles there. That is an example.

Lord Lewis of Newnham

195. Could I just say how delighted I am personally to hear this because I do believe this is one of our major problems at the moment, trying to decide when data collecting is data collecting as opposed to research or monitoring. There is a whole emotionalism that goes with these words. I am personally very concerned that we are losing out. As was very well said by Sir John, one of the primary objectives in certainly all our climatic work has got to be collecting the data and then utilising this in some modelling pattern, but this is only one aspect of what is an enormous problem. When you get down to it, we are very, very much lacking in data for any real environmental studies. This country fortunately—for the wrong reasons, or perhaps the right reasons—has had a good history of data collecting which has stretched over a long period of time, but unless we address ourselves to this in exactly the way I would agree Sir John is suggesting we can be in real trouble for the future.

Chairman] Thank you very much indeed, Sir John. You and your colleagues have provided us with a very valuable session. We are most grateful.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE
SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II —
INTERNATIONAL SCIENTIFIC PROGRAMMES)

Thursday 18 October 1990

THE ROYAL SOCIETY

*Professor M A Epstein, Sir Francis Graham-Smith,
Mr S J Cox and Dr Peter M D Collins*

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THURSDAY 18 OCTOBER 1990

Present:

Adrian, L	Kirkwood, L
Carver, L (Chairman)	Nelson of Stafford, L
Dainton, L	Nicol, B
Flowers, L	Sherfield, L

Memorandum by the Royal Society**THE UK RESPONSE TO PROPOSALS FOR INTERNATIONAL SCIENTIFIC PROGRAMMES****I BACKGROUND****1. Introduction**

This submission was prepared by an ad hoc group of Fellows under the Chairmanship of Professor M A Epstein, Vice-President and Foreign Secretary. The other members were: Professor J Dewey, Sir Francis Graham-Smith, Dr J Houghton, Sir Hans Kornberg, Sir John Mason, Sir Frederick Warner.

In this submission we set out the background to international scientific activity and to the specific issues highlighted by the Inquiry.

2. Types of international scientific activity

International science ranges from informal collaboration between colleagues in different countries to major treaty-based operations like CERN (for a list of acronyms, see annex C). Collaborative science begins with meetings between individual scientists and grows out of their professional relationships. Some collaborative ventures are driven from the "top", but they would founder if there were not a corresponding commitment from the working scientists. Scientific research is done by scientists, not by organizations, and that is as true for international projects as it is for national ones. This Inquiry is focused on programmes, but the emphasis on organizational issues, important as they are, should not obscure the significance of individual relationships in developing international science.

There are many different types of international scientific programme (ISP). For example:

- some are concerned with co-ordinating existing activities and collating existing data (e.g., networks organized by the ESF), while others are concerned directly with producing new knowledge (e.g., WOCE);
- some are set up by inter-Governmental treaties (IDNDR), while others are arranged through inter-agency agreement (IPOD);
- some involve "permanent" organizations running a series of programmes (IOC), while in others an organization is set up for a specific objective and disbanded (IBP) when it has been achieved;
- in some international scientific organizations, the partners pay an "entry fee" and then join, and pay towards, particular activities at their discretion (ESA); in others, the subscription covers all activities and selective participation is not possible (CERN);
- in some, participants contribute in kind (e.g., land or equipment) rather than in cash (La Palma Observatory);
- some involve enabling existing facilities in different countries to work together on a project than none could tackle individually (VLBI);
- some are concerned with moving people around (RS European Science Exchange Programme), others with bringing them together (Ciba Foundation symposia);
- some exploit a particular location (EISCAT), others exploit a particular piece of equipment (ESRF);
- some have just two partners (Anglo-Soviet micropulsations programme) others are multilateral (SWAP).

3. Rationale for establishing an ISP

ISPs are set up for many reasons, including:

- need to share cost (space, high energy physics);
- the subject matter crosses national boundaries (European geotraverse);
- global subject matter (ocean/atmosphere coupling);
- need for access to a specific location (rain forests, Lake Baikal, high latitudes);
- sharing the labour to reduce the total time needed to complete a project (human genome mapping);

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[Continued

- avoiding unnecessary multiplication of national research programmes;
- the need for worldwide consensus (taxonomy, stratigraphic correlation);
- the need for worldwide standards (advanced telecommunications);
- access to specialist skills not available nationally (especially for smaller countries).

ISPs may also have a political aspect. The European Community, for example, funds research in order to strengthen the scientific and technological basis of European industry. But projects have to involve collaboration between two or (preferably) more Member States, in order to contribute also to the broader objective of increasing social and political cohesion within the Community. Similarly, projects approved under the IGCP must include developing countries among the partners.

II SPECIFIC ISSUES

In this section we deal, in order, with the specific issues raised by the Inquiry.

4. *Advantages and disadvantages of joining ISPs*

The advantages of participating in an ISP mirror the rationale behind its establishment. In general, participation in an ISP gives a research group access to an activity that would otherwise be beyond its grasp. It also gives it access to other groups, who might be unwilling to share data with those who had not contributed to the programme.

5. *Large facilities*

Large facilities are a special case of ISPs, subject to much the same considerations as outlined above. However, because large facilities are fixed in a specific location, the host country is likely to carry the largest share of the cost and secure the largest share of the scientific returns. A corresponding degree of commitment is required from the host country. Relevance to national goals becomes all the more important.

Large facilities also bring benefits to the local economy through the spending of their staff, and to the national economy through taxes on salaries paid by international subscriptions.

Large facilities need not involve large international administrations. At La Palma Observatory, for example, the partners contribute in kind rather than in cash, and each is responsible for administering its own contributed element. In VLBI, data collection is the responsibility of widely distributed observing facilities, each managed locally, while data reduction may be carried out at a central, jointly managed location.

6. *Machinery for initiating ISPs*

See comments in paragraphs 2, 3 and 8.

7. *Technical and financial criteria*

Proposals for research programmes or projects at the national level are, in general, subject to a fairly rigorous process of peer review. We are concerned that international programmes—especially those of the European Community—can sometimes be established without independent critical scientific scrutiny. Peer review is needed both at the central organization (e.g., the EC) and at the level of the individual participants (who need to judge the potential merits of participation). There may be a role here for bodies like the Academia Europaea and the various specialist scientific societies operating at the European level. It is essential that those considering setting up or participating in ISPs have access to expert advice that is scientifically sound and politically independent.

8. *Decision to participate*

There are many different types of international scientific programme. ISPs arise from a variety of sources (national governments, international governmental or non-governmental organizations, groups of scientists). An invitation to participate may be received by an Embassy overseas, by a Government department, by a research council, by an academy or by an individual research unit. When the request comes, the proposal may still be in an early, imprecise form. All this makes it difficult to respond quickly and efficiently to proposals for ISPs.

We are not aware of any single mechanism to prepare a UK response to proposals for ISPs. This absence of clear procedures can lead to delays in responding, giving the impression to the international community (yet again) of British reluctance to take a role in international co-operation.

Participation raises the group's international profile, which may in turn increase its domestic prestige. Where participation is by invitation, it serves to validate a group's reputation. In some circumstances, the support of a reputable international organization may make it easier to secure national funding for a particular area of research.

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Participation in an ISP may accelerate the development of ideas and, ultimately, their commercial exploitation; this is of obvious importance in areas where there is competitive advantage in being early to market.

The disadvantages of ISPs relate mainly to diminution of control and to loss of time. IPSs require consensus both among the participants and between the participants and the funding agencies. It takes time and effort to establish and sustain this consensus. Participants have to be sufficiently adaptable to accommodate their partners' goals.

An ISP can have several objectives, political as well as scientific. This needs to be recognized by all the participants if consensus between the researchers and the funding agencies is to be achieved.

The need to negotiate and compromise with other partners means that it may not always be possible to apply to an ISP the same rigorous selection criteria normally applied to national programmes or projects. Proposals that would not otherwise secure national funding may thus nevertheless be funded through an ISP to which the UK contributes; conversely, a provisional commitment to an ISP may fail to meet more rigorous national criteria and therefore have to be withdrawn. Because of the need to balance the aims of the various partners, one has less control over the agenda of an ISP than of a national programme, and less flexibility to adapt rapidly to changing circumstances.

A potential hazard of joining an ISP is that the priorities of one of the partners may change to such an extent as to threaten the direction or the financing of the programme. The other partners then have to adjust their own involvement and may end up with a different package from that originally envisaged.

The additional time needed to participate in an ISP can be significant. The management of a multinational operation is likely to be more complex than a purely national one. Decision-making processes can be cumbersome where, for political reasons, equal weight has to be given to all participants. This can weaken the scientific credibility of an ISP where the participants are not all equally strong scientifically.

Participation in an ISP gives one leverage: the "entry fee" gives access to an activity costing several times more. However, an ISP may not give good value for money if administrative expenses attenuate this leverage, if quality control of the work is inadequate or if the research moves in a direction marginal to a given participant's interests. If the costs of ISPs are taken from national research budgets, international considerations have to be weighed against national ones.

Treasury rules on additionality, however, are more pernicious. In effect, they claw back any "excess" income derived from EC schemes by participating Departments, and thus penalize bodies that are successful in competing for funds from international programmes. We strongly urge that these rules be reconsidered.

11. Impediments to UK participation

Some impediments such as commercial secrecy and intellectual property are not unique to ISPs: they apply to participation in any research programme with potential commercial goals. They may, however, be more complex in cases where partners from a variety of different cultures are involved. The importance of clarifying IPR arrangements in collaborative research is now well appreciated, and generally gives rise to few problems. Currency fluctuations are more difficult to guard against, especially in the major ISPs such as CERN and ESA; some adjustment of Treasury rules here would be desirable. It is to be hoped that the CoCom rules will be reconsidered in the light of developments in East Europe.

12. Impediments in other countries to participation

Impediments faced by other countries may include non-convertible currencies, the smallness of their scientific communities, availability of funds to cover initial negotiations and to pay the national contribution to the ISP, and possible disagreements with other partners over the balance between scientific and commercial objectives.

The Royal Society, with its strong connections to national academies of science throughout the world, has a special role to play in helping the development and reorganization of the East European academies as they democratize their constitutions and working practices. This should lead to greater participation by the East European countries in ISPs outside the Eastern bloc. Additional funds are needed to carry this work forward. There may be a similar role here for the Academia Europaea.

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[Continued

III RECOMMENDATIONS

Given that there is a procedural vacuum in the UK for assessing declared international programmes, particularly in the intergovernmental field, we recommend that HM Government establish a standing group to advise it on any new emergent international programmes. This will help the UK Government decide on whether participation is desirable and which agency should take the lead. Decisions of this character have long been bedevilled by inter-departmental rivalry leading to diffusion of responsibility and slow decision-making. The proposed standing group should be assigned the power to call on appropriate advisers (in or out of government) to assist it in formulating advice. Alternatively, we recommend that the Royal Society be invited to provide that advice to Government, subject to the provision of the necessary resources to the Society.

Fresh thought needs to be given to finding ways of protecting research council budgets from the effects of large fluctuations in currency exchange rates. The effects of such fluctuations often fall disproportionately on the relatively small portion of research council budgets assigned for flexible responsive-mode funding.

The key issues to be determined quickly are:

- (i) whether the ISP is of particular interest to British scientists;
- (ii) how far the ISP meets the ABRC criteria for funding (timeliness, pervasiveness and excellence; exploitability, applicability and significance for education and training; and affordability);
- (iii) how the UK contribution will be funded;
- (iv) who will take the lead.

Once it has been decided to participate in an ISP, a mechanism for monitoring the scientific activity needs to be established.

UK participation has usually been most effective when a strong champion has emerged, willing to push the proposal and to co-ordinate all relevant interests. An example is the role of the Meteorological Office in establishing the Scientific Assessment Group on Climate Change. In the absence of a single research council or a Ministry of Science, the newly reconstituted ABRC may be able to exercise an effective co-ordinating function, since it will require all HORCs to endorse collective decisions. The current lack of a scientific focus in the UK to co-ordinate and lead initiatives is a matter of some concern.

9. *Government practice*

In the UK, funding for international programmes comes from research budgets rather than foreign affairs budgets (except for research supported by the ODA). This underlines the need for scientific peer scrutiny of the international programmes, since they will be drawing resources away from national programmes. However, political as well as scientific criteria may influence UK decisions about participation, since international programmes may have diplomatic as well as scientific objectives. In some cases the scientific community would not be able to implement a decision, taken on purely scientific grounds, to withdraw from an international scientific programme. Some countries use foreign affairs budgets rather than research budgets to fund international work and such an arrangement in the UK would ameliorate the stresses in research council budgets which frequently result from adverse changes in currency exchange rates. But the Royal Society holds that the distribution of resources for scientific research should not be determined without scientific advice, and would therefore be opposed to moves to commit funds to international projects purely on diplomatic grounds.

10. *Additionality and attribution*

Attribution—the setting of various parts of the UK's contribution to, for example, the EC budget against the Government Departments most closely involved—has some merits, since it encourages assessment of the balance of advantage between national and international activities and thus promotes more rigorous peer review of the international activities. However, attribution can lead to Departments taking too parochial a view of international activities, as evidenced by the protracted negotiations over the EC Framework Programmes, and this needs to be guarded against.

ANNEX A: THE ROYAL SOCIETY AND INTERNATIONAL SCIENTIFIC PROGRAMMES

As the adhering body of the UK to the International Council of Scientific Unions (ICSU) and to 19 of its 20 Unions and Scientific Committees, the Royal Society has had responsibility since the inauguration of the first major international collaborative scientific programme, the First International Polar Year of 1882-83, for:

- (a) assessing the potential of international programmes for serving UK scientific interests;
- (b) assessing the potential contribution from the UK scientific establishment (both governmental and academic);

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- (c) stimulating and co-ordinating UK participation in international programmes.

These tasks have almost invariably been exercised by specialist committees acting on behalf of and advising Council of the Royal Society.

For the First and Second International Polar Years and the International Geophysical Year, the Royal Society was responsible for organizing the UK contributions aided, in the case of the IGY, by funds provided by the Treasury. With the establishment in 1965 of the Science Research Council (now the SERC) and the Natural Environment Research Council, the responsibility for funding the research element of formal UK participation in international non-governmental scientific programmes passed from the Society. Thereafter, it was the policy of HM Government that there should be no earmarked monies for the research elements of UK participation in international programmes.

The Royal Society now supports:

- (a) international non-governmental organizations co-ordinating collaborative programmes (through annual subscriptions);
- (b) UK scientists participating in the peer review of plans and progress in international programmes, and in contributing to them (through lubricating funds);
- (c) certain international organizations in compensation for funds that they would otherwise have received from UNESCO had the UK remained a member (through annual subscriptions);
- (d) specific bilateral and multilateral research projects, currently those to study the tropical rainforest in Malaysia, and the ecology of Lake Baikal in the USSR (through earmarked provision);
- (e) young postdoctoral scientists wishing to attend meetings organized by parts of the ICSU family, all of which are concerned with the advancement of natural knowledge and some of which are responsible for organizing international programmes (through separate grants).

The Royal Society has also established an information office to ensure that details of international programmes and activities promoted by members of the ICSU family are brought to the attention of the relevant parts of the UK scientific community, in order to make known the opportunities for research and for the exchange of data, results and ideas that are often the seedcorn of new collaborative ventures.

The supervision of the subscriptions and financial allocations for these contributions by the Royal Society to internationally oriented scientific activities is undertaken by specialist committees appointed by and reporting to Council of the Royal Society.

ANNEX B: SOME EXAMPLES OF INTERNATIONAL SCIENTIFIC PROGRAMMES

1. Global or multi-lateral programmes

- (a) *Intergovernmental (IGO)*
 - International Decade of Natural Disaster Reduction
 - International Hydrology Programme
 - International Oceanographic Commission programmes
 - Man and the Biosphere Programme
 - UNESCO programmes
 - World Weather Watch
- (b) *Interagency*
 - International Space Year
 - International Phase of Ocean Drilling
- (c) *International non-governmental (NGO)*
 - ICSU programmes, for example:
 - International Lithosphere Programme
 - International Solar-Terrestrial Energy Programme
 - International Geosphere-Biosphere Programme
 - Biological investigations of marine Antarctic stocks and species
- (d) *Joint IGO-NGO*
 - International Bioscience Networks (UNESCO with ICSU)
 - International Geological Correlation Programme (UNESCO with the International Union of Geological Sciences)
 - World Climate Research Programme (WMO with ICSU)

2. Regional programmes

- EUREKA
- European Geophysical Traverse

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[Continued

European Incoherent Scatter radar facility
 European Programmes on Climatology and Natural Hazards
 Joint European Torus project
 Nearly all EC R&D programmes

3. **Bilateral programmes**

Anglo-Soviet Micropulsations Programme
 Danum Valley Centre
 Lake Baikal Project
 Royal Society Japan Programme
 Scandinavian and British Radar Experiment

ANNEX C: ACRONYMS

ABRC	Advisory Board for the Research Councils
ACOST	Advisory Council on Science and Technology
CERN	European Organization for Nuclear Research
CoCom	Co-ordinating Committee on multilateral export controls
EC	European Community
EISCAT	European Incoherent Scatter radar facility
ESA	European Space Agency
ESF	European Science Foundation
ESRF	European Synchrotron Radiation Facility
EUREKA	European high technology programme
HORCs	Heads of Research Councils
IBP	International Biological Programme
ICSU	International Council of Scientific Unions
IGCP	International Geological Correlation Programme
IGO	Intergovernmental Organization
IGY	International Geophysical Year
IOC	International Oceanographic Commission
IPOP	International Phase of Ocean Drilling
IPR	Intellectual Property Rights
ISP	International scientific programme
NGO	Non-governmental Organization
ODA	Overseas Development Administration
RS	Royal Society
SERC	Science and Engineering Research Council
SWAP	Surface Waters Acidification Programme
VLBI	Very Long Baseline Interferometry
WCP	World Climate Programme
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment

Examination of Witnesses

PROFESSOR M A EPSTEIN CBE FRS, Foreign Secretary and Vice-President, SIR FRANCIS GRAHAM-SMITH FRS, Physical Secretary and Vice-President, MR STEPHEN J COX, Assistant Secretary (International Affairs) and DR PETER M D COLLINS, Head of the Science and Engineering Policy Studies Unit (SEPSU), called in and examined.

Chairman

196. Professor Epstein, we are very grateful to you and your colleagues for coming along today. I am sorry to have kept you waiting. We have not met since July and had a number of practical details to clear up. We are most grateful for the written evidence which you have sent us which was very clear. Would you like to introduce your colleagues and then say anything you wish to say in amplification of the paper you have sent us.

(*Professor Epstein*) Thank you very much, Lord Chairman. Thank you for that very kind opening

welcome. I have got here with me, on my right, Sir Francis Graham-Smith who was lately Astronomer Royal and is currently the Physical Secretary of the Royal Society. On my left are Mr Stephen Cox who heads our International Secretariat, and Dr Peter Collins from our Science and Engineering Policy Studies Unit. Things we might like to say in addition to the written submission: I think talking about it, since it was sent, the thing which we really feel might be emphasised, is that international scientific programmes are not part of life, they are not things which exist of themselves, they are things which are set up in each case for a specific purpose. Unless that happens, either between scientists bottom up or top

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MR S J COX and DR PETER M D COLLINS

[Continued

[Chairman *Contd*]

down inter-governmentally they really do not have a *raison d'être*. I think we want to make the point we do not regard them as just part of life, they have to have a rationale. The two things that we would like to emphasise, and I am sure Sir Francis will talk to that in a minute as well, are first of all this sort of lacuna at the centre of the organisation of British science. It is as if there is no conductor for the orchestra, in a sense, so that when things come in there is no focus which can deal with it and lead, so they tend to get shunted around. I know Stephen Cox has a list of things which took a long time getting off the ground because of this. There is a need for something to be established to cope with the various programmes and suggestions that come in. The second thing we want to stress is the perturbation of finance in the Research Councils because of currency fluctuations. Obviously joining the ERM will help in some respects but it does not cover Swiss Francs, for instance, and the slop in the system which is allowed, as I understand it, is about 12%, that is six up and six down, but that still can be quite an appreciable perturbation. Everyone is very familiar with the effects of subscriptions to CERN and the other big sciences of SERC. But, to look at subscriptions paid by MRC, I was quite surprised to find they totted up to something like three and a half million pounds and if we get a lot of change unexpectedly that is going to have a very serious effect on the £150 million total. This 2% can be influencing the £150 million of the total MRC budget, so it is not just SERC. Those are the two things we want to highlight.

(*Sir Francis Graham-Smith*) Essentially those are the two points. There is a great diversity of programmes and we see that most of them quite properly start with interchange between scientists which we are very anxious to foster. We see that they often grow out of that and they often provide a means for interchange of scientists and scientific ideas, so that is a good thing. My own experience of international programmes is essentially of two, one of which was the European collaboration in astronomy which grew up in the Canary Islands from an interchange between individuals and went very straightforwardly with no problem. The other one, also mentioned in our submission, is VLBI and European collaboration where it became appropriate for the programme to be funded from European sources. That was, I think, less than satisfactory. It still has not been funded but it did seem to us in that case there was no clear channel for the European Commission to obtain advice and no clear channel for this country to promote its own interests in the programme. So, I am sure as you have already found there is a great diversity, but I think there will emerge a number of cases where co-ordination within this country has been lacking.

(*Professor Epstein*) Can I come back to the business of the European Community again? There is some anxiety about the lack of peer review of what the administrators in Brussels do. I am not talking about once something is set up and people are

putting in applications, then there is CODEST which gives them a sort of peer review although that is made up of government appointees and not independent scientists. The actual policy decisions which lead to the programmes which, for instance, CODEST looks at are not peer reviewed. I am not suggesting that there should be some organisation in this country set up to do that but at least there should be some opportunity to nominate people when there strategy decisions being taken, decisions which seem to be taken now entirely by the bureaucrats. There was a time when it was thought that the Academia Europaea or even the ESF would be doing the reviewing but nothing has come of that.

Lord Flowers

197. Could I just quiz this point. One can look at these two things: one can say in each country there should be a peer review of a project in which people from that country are involved, or one could say no, since this is a European project funded from European sources and through European sources it should be peer reviewed on a European basis, ESF or Academia Europaea, as you say, or something. Which really would you press for?

(*Professor Epstein*) I think it is much easier to establish a peer review on something which is going on nationally where there is some input and relationships with scientists. What we are concerned with, I think, is the second alternative that you mentioned where in Brussels there is apparently a lack of this.

Chairman

198. Can we just leave this peer review and European projects aside at the moment and concentrate on this important point that was, in fact, the main reason why we undertook this study on your recommendation, this apparent lack of machinery either to co-ordinate or to see these things were got going, or were supported or were maintained.

Two things which struck me. One is the emphasis in all the evidence we have received—and you yourself have repeatedly stated this—of the enormous variety of International Scientific Programmes. Different sorts have different purposes, arranged in different ways, financed in different ways, supported in different ways a variety which I would have thought made it very unlikely that one single machinery would be appropriate for dealing with all this. The other is that there is absolutely no mention in your paper at all of the Chief Scientist in the Cabinet Office and his staff or indeed the Chief Scientist in any department. As we see it, certainly for the European framework programme and for the international scientific programmes which are arranged on an inter-governmental basis, it is very much the function of the chief scientist's staff in the Cabinet Office to be exactly what you have been describing for those sorts of programmes as well as others. That surprises me. The other thing is how

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[Continued

[Chairman Contd]

much do you yourself see yourselves as being the body who should be doing this and if you are not doing it, why are you not doing it?

(*Professor Epstein*) Although we have not been charged to do it there is a suggestion here that the Royal Society might, in a sense, be a focus for one type of reviewing; obviously as you have pointed out the possible schemes are all different. But, to follow that up, I think one has to have some indication (which we do not have and do not have access to) of the scale of the thing. I mean, there are inquiries coming in twenty a day or twenty a week or twenty a year? We do not know how much one would have to look at in terms of proposals.

199. If you do not know who does know?

(*Professor Epstein*) I have not any idea where one could identify that.

200. I find this very extraordinary because one of the suggestions I made of what we might study was the interchange of scientific information. I was informed, "No, this all works very well" and everybody knew, any scientist working in a particular field knew, all the people working in his particular field and therefore they would presumably know who were the people looking for —

(*Professor Epstein*) I think we are talking at different levels. Yes, at that level it all works and certainly for some programmes we have science information services, a computerised data base at the Royal Society to answer just those questions on the Soviet Union, on the People's Republic of China and now on Japan so that is up and running. No, I am talking about where proposals come in for much larger kinds of International Scientific Programmes. At the scientist to scientist joint project type of level, I do not think there is a problem for us.

201. When you say "come in", those funds, do you see them coming in through a Government department or to a university or to a specific laboratory or where?

(*Mr Cox*) I could give you two contrasting examples. If one takes IDNDR—International Decade of Natural Disaster Reduction—that came from an idea of the President of the US National Academy of Sciences to the United Nations General Assembly who passed a resolution saying this was a good thing. It then came to the Foreign Office. I am not saying for any particular reason but the focus seemed to dissipate and nobody knew what had happened to the UK's wish to get involved in this activity. If one takes a contrasting programme, the IGBP—International Geosphere Biosphere Programme—this started in a conference in Canada in 1984 and has come up through the scientific community and the Royal is now providing a focus for activity in that particular area. So if the programme comes up through the scientific community rather than through the governmental structure, we do pick up the baton where we can.

Even though, in the case of the IDNDR, it was an individual scientist's initiative, if it comes through Government machinery even though it is something individual scientists would be better dealing with, there is no means of filtering this through the right mechanism in the UK.

Lord Flowers

202. Are there many cases where things have come through Government and not been given to you?(*Mr Cox*) We do not necessarily know. There are examples that come up from time to time that we know about and the IDNDR is a good example of this.

(*Professor Epstein*) It sat about for two or three years before anything happened in the UK.

Baroness Nicol

203. In your recommendations you indicate the need for a standing group to advise the Government and you say the Royal Society could be invited to provide that advice, subject to the provision of necessary resources.

(*Professor Epstein*) Yes.

204. This seems to indicate you have in your mind some kind of machinery you could put into operation to fulfil the need.

(*Professor Epstein*) Yes.

205. Would you like to describe how you see it working?

(*Professor Epstein*) Yes, it was just that point, Baroness Nicol, that I hung on the question of how much of this advice would be required, how many of these programmes. We do not have any feel for that at all. If it is a question of providing independent scientific specialist appraisal from amongst the Fellowship well then I think you have got, in the Royal Society, the best of British scientists in all fields and that could be drawn upon, those people could be used. Now, if it is on a small scale, and there are three or four proposals coming in a year to harness that expertise, one would need a small secretariat and the servicing of the committee work and structures; that is what we had in mind. If it is something much more elaborate and important well then it is a different ball game, does that answer the question?Baroness Nicol] Yes, I think so.

Lord Dainton

206. I am very surprised by the turn this discussion has taken. Going back to my experience in CSP and the ABRC and the Research Councils, the position was clear in the period of Lord Zuckerman and Sir Alan Cottrell, when he was in the Cabinet Office, and the position was if things came in through the Foreign Office they would naturally find themselves on the desk of the Chief Scientific Adviser. They would naturally, if they

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concerned research councils rather than the DTI also find their way to the research councils. If research councils—who have responsibility for public funds which are generally called in to go into these international activities—want to draw on any scientific advice, including that which might best be given by the Royal Society, that would be the route by which that is done. Are you saying this does not happen now?

(*Professor Epstein*) No, that would be a very bold statement.

207. What is the nature of the complaint? What is the position?

(*Professor Epstein*) Some of the time the proposals go round and round departments and who is going to take the lead department takes a while to establish.

208. Is not that responsibility fundamental to the Chief Scientist?

(*Professor Epstein*) It is indeed.

209. This is a criticism of the Chief Scientist department?

(*Professor Epstein*) I think that answers Lord Carver's question as to why he is not mentioned in this paper.

210. That is quite helpful. It is a serious gap from the point of the work with British science.

(*Professor Epstein*) In some respects, yes.

Chairman

211. It is not the machinery that is missing, it is the way it is working.

(*Professor Epstein*) Well, I do not know.

Lord Dainton

212. The end result is not satisfactory.

(*Professor Epstein*) In some cases, yes. One notices things, yes.

Lord Adrian

213. May I pursue that somewhat and ask whether you would be happy with the situation as I think it occurs, if an international programme is, so to speak, being initiated at an inter-governmental level and having a certain amount, therefore, of, shall I say, political esteem, it is then adjudicated essentially by the ABRC and the research councils. Do you see any conflict of interest when contributions to that programme may actually have to come by top slicing the research council's budgets?

(*Professor Epstein*) That is for ABRC to set its priorities and our influence on ABRC, as it has been newly reconstituted, has, unfortunately, declined. So, I do not really know how that is going to work in the future.

Lord Flowers

214. Professor Epstein talked about the absence of any central focus for this sort of thing compared with France and Germany. Do the French and Germans do this sort of thing better and if they do is it because they have ministers responsible for scientific research in some fashion or another tied to education in one sense and industry in another? It does not matter how they are tied up.

Is it the absence of a minister that matters, or let us say a government department or is it just that there is nobody in this country that can do the job? Could you do the job a minister could do?

(*Professor Epstein*) I personally think, and this is a personal view, it has not been canvassed or discussed at the Royal Society, I think the answer is exactly as you put it. They do have a Minister of Science and it is not just a question of having one man and a boy that will not work, that is window dressing. You have to have a Minister of Science in a Ministry with clout that can raise the steam. That is the reason why Riesenhuber in Germany has been so incredibly successful. We need a clone of Riesenhuber.

Chairman

215. What we are really talking about now is a failure in the machinery, or lack of machinery, to deal almost exclusively with top down projects which come in at a governmental level, that is what we have been talking about. There are various people concerned with this at the moment, there is yourselves, the Chief Scientist at the Cabinet Office and the Chief Scientists in other departments and the ABRC and very heavily, I suppose, SERC. Do you want a new machine, and if so what sort of new machinery, or do you want to improve the working of the existing machinery? If you want to improve the working of the existing machinery where would you put the emphasis? You have just said you think there should be a Minister of Science which in a way would suggest you would put more emphasis on the Cabinet Office and Chief Scientist at the moment, or would you put more emphasis on ABRC or take more responsibility yourself?

(*Professor Epstein*) The Royal Society, and I can speak for the Society because the Council endorsed the view, was extremely enthusiastic for a national research council, the Morris recommendation. Such a structure would have helped.

(*Mr Cox*) One of the problems of talking about international scientific programmes is they are so diverse, so when an example is given each one is a specific case, and to assume they could only be top down or bottom up is not the case, they come from all sides. An example of a problem the UK got into was in relation to Phase 2 of the ODP—Ocean Drilling Programme. We took part initially and were seen to be dragging our feet in taking part in Phase 2 and eventually went in rather late in the day because there were all sorts of arguments about funding, who should pay, where the funding should

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go and this gave our partners the wrong impression. This is really what in essence we are talking about. The UK very often in dealing in international scientific matters is giving the wrong signals to the other partners instead of making a clear decision to go in wholeheartedly or a clear decision, for that matter, to stay out. We are between those two extremes and try to manoeuvre our way through. I was in conversation the other week with the Minister of Science in Spain and he made the point clearly. He felt the UK was, in international science, frequently giving the wrong signals by not being clear about its own attitude, whether that is a governmental attitude or non-governmental attitude did not seem to matter, and by not fielding scientific people in international discussions. The discussions on the ODP epitomised that problem.

Chairman

216. Given the decisions taken on the Morris Report about the future of ABRC and given the extreme unlikelihood of the ex-Scientist Prime Minister having a Minister for Science, on the assumption the machinery stays much as it is now, where do you think the main emphasis should go now in trying to focus these things better?

(Professor Epstein) I suppose if the Chief Scientist in the Cabinet Office had a beefed up role it would help. One hopes maybe with the new appointment we might see a higher profile, I do not know.

Chairman] Rather than try and put more emphasis on ABRC.

Lord Dainton

217. There was a remark made by professor Epstein which worried me slightly when he referred by implication in rather scathing terms to the new ABRC constitution.

(Professor Epstein) No.

218. I think the record will show that. Be that as it may is there a feeling that the Royal Society is not getting adequate consultation over international matters at the present time through ABRC? Would you want a better channel of communication now it is in its reduced small form?

(Professor Epstein) Can I put the record straight, if it is not. I think the only thing we were a little concerned about with the reconstituted ABRC was that we no longer have an input there.

219. That was the point I was making.

(Professor Epstein) We were really very disappointed about that. If you are now saying we are not being consulted, I simply do not know, it has not been going on long enough.

220. I think you were saying the ABRC mechanism would help if you had, as of right, some

requirement that you should be consulted on these international affairs by ABRC with these international matters in front of them?

(Professor Epstein) Gosh, yes. We know of something that is coming up through ABRC, which we hear about, which is a source of concern to us actually at this moment and we do not have an input to register that concern.

Lord Flowers

221. May I be provocative for a moment. The Royal Society have been talking about taking an executive position effectively and getting in the chain, direct chain, to Government on this business of International Scientific Programmes. The Royal Society's strength is really that it can be an independent critic of any matter, particularly matters where Government's methods involve scientific matters. If you get into a position where you actually are the executive organ then you lose that independent role of critic. Is that what you want to do?

(Sir Francis Graham-Smith) No, we do not at all. We are very anxious to perform an advisory role, not an executive role. Of course, you cannot advise on something you have not been asked about. We want to preserve our position as giving independent scientific advice.

Chairman

222. Can we now turn to slightly different aspects, from bottom up aspects. There are two fields in which we have received a considerable amount of evidence. One is the difficulty that scientists have when they have agreed with colleagues overseas without having formed the nucleus of a future programme, then of getting all the support for it, getting financial support, getting support from the government department to get the whole thing properly established, and the general feeling of the Cabinet Office, the Chief Scientist, as to the certain guidelines as to how to set about all this. A great deal of the evidence we have received is that many people do not know about these guidelines, or they do not meet the point. If we can deal with that and go on to the next one, which is also a criticism that it is quite difficult, some people are much better at it than others in different laboratories, knowing what is going around in the international field, knowing there are possibilities for good co-operation before you get to this stage of having discovered who the people are who are willing to co-operate, getting the thing set up.

Have you got comments on that?

(Professor Epstein) Well, I think that our various schemes for joint projects with our partners overseas—the Royal Society has agreements with 47 different countries—in most countries or many countries there is more than one partner, and in a lot of our schemes we do have provisions for joint projects. The small way that we can help is to facilitate travel

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and consultation; the individual scientific participants in the two countries must find the research project funding themselves, obviously. Individuals need to know who is interested in this particular piece of research which each wishes to pursue together. We can help in the countries where it is quite difficult to know that, like the Soviet Union, China and Japan, through our information services but the whole point of our joint project schemes is to facilitate. We cannot support and fund the actual research, that must come from the funding agencies in each country. But, facilitation of the co-operation is exactly what our joint project schemes are for, that is to allow scientists to travel to and fro to consult together to meet and so on. We provide the funds for that.

223. Do you see yourselves as providing an information service? Would you hear about a possible co-operative project in some other country and either tell people in the same field that this was going around and they might be interested or tell the foreign country who they might get hold of?

(*Professor Epstein*) That would not be across the board but it does happen indeed. The most recent example I can think of is Lake Baikal where I am sure you know the Soviet scientists are extremely keen to set up an international research institute at this unique body of fresh water. We had an ad hoc committee on Lake Baikal. We made it known this was going on. We had a meeting or two at the Royal Society about this. We have facilitated joint projects with scientists in the Soviet Union on Lake Baikal because this opportunity came up.

224. But you are not complaining of a lack of machinery, lack of Government machinery for this sort of purpose?

(*Professor Epstein*) This is the kind of joint project which works, scientist to scientist coming up from below. Bottom up joint research, is not so difficult to arrange. I do take your point about the dissemination of information, about opportunities, and that I do not think is a role we have got. A lot of people do not know what is available in Brussels and when they find out they are absolutely appalled at the paperwork.

225. You reckon you do not come into this business of, as it were, once a group of scientists or scientists in this country have formed the nucleus for carrying out the programme, you are not involved in any way in the machinery of how they get support for it, that is entirely a matter for the research councils and the Government?

(*Professor Epstein*) Yes, but we are involved in facilitating their travel. We even fund travel in order to explore such a joint venture.

226. Do you get the impression this is something that works well, works more or less satisfactorily or does not work well?

(*Professor Epstein*) The part we know about works jolly well but what is out there in the dark, I do not know about.

Lord Kirkwood

227. Most of this discussion has been about reaction to projects which have arisen from outside, from other countries. What about the initiative shown by UK scientists? What is the machinery for picking those sort of things up? Is there a lack of initiatives originating from in this country?

(*Mr Cox*) The problem the UK scientist faces is that in competing for funds for they must compete through the normal system of peer review in the research councils and therefore the proposal has to be viewed in relation to any other proposal that comes up. Initially, setting up an International Scientific Programme or pursuing an International Scientific Programme is intrinsically more difficult because of the international nature of the collaboration and therefore I suspect that it is more difficult to get funds. Clearly the peer review system is designed to pick the best science irrespective of other considerations so if the best science is a UK collaboration then that is the one that will get funded. That is, I think, at the initial stages the difficulty many UK scientists face. There are opportunities for UK scientists to find out about Commission funding, for example, through the research councils office in Brussels and indeed the British Council has also set up an office to provide information about opportunities for British scientists from multi-lateral agencies such as the Commission. There is the ESF, European Science Foundation, their network structure also provides opportunities for British scientists, but I suspect these opportunities are not as well disseminated here as they could be and the means of doing that is something we should look at more carefully.

(*Dr Collins*) One might add that many universities have appointed European liaison officers precisely to feed in mainly Brussels focused opportunities, though no doubt they will broaden their remit in due course.

Chairman

228. To pursue this funding point. I rather gathered that you would not be in favour of international projects being funded quite separately from the funding of the research councils because would you not be in favour of any proposal for an international programme having to be considered by a research council in relation to priorities for national programmes? Whereas it has been suggested to us that once the thing is an international programme it should be funded as some other countries do by the Foreign Office.

(*Professor Epstein*) I think we are quite clear on that. There are two things being mixed up in what has been said to you. Clearly the evaluation must be done within the research councils because the money is coming out of the total UK scientific budget and

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must therefore be set alongside other priorities. The point people have been trying to make to you about funding international programmes through the FCO is a different one. I think they are wrong to say it should go through the FCO. I think the point they are getting at is it should be funded in the same way as FCO expenditure abroad. That is to say if suddenly the dollar goes sky high against the pound you do not cut the funds of the British Embassy in Washington. I think that is the point people are trying to make: if the CERN contribution goes sky high you do not say to SERC you have to find the rest out of your existing budget come what may.

229. If the pound went high you would then tell the research council they would have to hand the money back?

(*Professor Epstein*) Absolutely. That is exactly what happens with the FCO expenditure. It should be in a parallel form, not that it should go through FCO but that it should work in the same way.

230. I think both views are put forward. Your view is quite clear it has to be considered within the research council's own priorities against national ones.

(*Professor Epstein*) Of course because it comes out of the science vote and anything taken out diminishes against something else.

Lord Nelson of Stafford

231. I was very impressed by your paragraph 8 which refers to decisions to participate which comes out also in evidence we have received. You refer to delays which occur in making a decision to participate.

(*Professor Epstein*) Yes.

232. I am not very clear from what has been said so far as to how you think that this situation should be improved.

Your last sentence says: "The current lack of a scientific focus in the UK to co-ordinate and lead initiatives is a matter of some concern." That theme comes through our received evidence all the time, the procedures are too slow, we are following not leading, we are losing the initiative. This seems to be a very important factor to my mind. I would not like our meeting to go by without hearing your views on how we can rectify that.

(*Professor Epstein*) This goes back to the question, again, Lord Nelson, of who is at the centre; is it the Chief Scientific Advisor to the Cabinet Office, or a putative Minister of Science, or whatever. This is where the lacuna is, there is no conductor. It is passed round to departments that have an interest, to the research councils, and they are all discussing and jockeying and time passes.

(*Dr Collins*) The whole framework programme is perhaps a special case of this. The length of time it took for the second framework programme to be

agreed, I think I am right in saying, was a direct consequence of the fact that the UK contribution for that had to be shared out, was attributed to specific lead departments. If those individual departments do not want to be the lead but want to share it with someone else who does not want it you have a lot of horse trading because their framework contribution has to be set against their national priorities. The lack of lead departments is not just a matter of someone saying this is a good idea, it is someone putting up the money for that. That situation one saw again with the example, if one can re-use an example, of the Ocean Drilling Programme where everybody said: "How super, you pay" and that cycle brought us to the brink of not being able to join at all.

233. You are saying people are standing back and saying: "Do not make a decision. If you make the decision you will be landed with paying for it, let somebody else pay."

(*Sir Francis Graham-Smith*) The second example of the VLBI programme, the one that took a long time, that was a factor because SERC would have lost by advocating that programme in a sense. There was no-one, as it seemed to us, in this country who was in a position to present this to the EC as a nationally supported programme.

Chairman

234. Is that something you would see the ABRC doing?

(*Sir Francis Graham-Smith*) The ABRC would be appropriate, or chief scientists would be appropriate, but there was no agent doing that as we saw it.

235. You put the whole system in reverse if, in fact, there are funds of money allocated to international science projects and people could apply for them?

(*Sir Francis Graham-Smith*) That would be one way of doing it. Of course, the European money we would regard as such a fund but it did not seem easy to recommend from this country that that fund should be spent in such a way.

Chairman

236. But there would be great disadvantages in having a sort of block fund and saying that is for international science.

(*Sir Francis Graham-Smith*) I would agree entirely.

Lord Adrian

237. My Lord Chairman, there must be some international programmes where there is indeed, and perfectly legitimately, a political reason for entering into them and if the research councils are asked essentially to judge them on scientific merit then

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there must at some stage be a mechanism for relating these two different priorities. They might in certain instances clash. I wonder whether you know how that is achieved. I know it is not necessarily a field in which the Royal Society is specifically involved but I wonder if you have any experience of it?

(*Professor Epstein*) In a small way, a very small way, yes. We felt from the very beginning that there was an urgent need when the changes started 18 months ago in Eastern Europe to try and do something to help the state of the scientific base there. The Hungarians were the people who got their act together first and reformed the Hungarian Academy of Science which was a big funding agency on the usual Stalinist pattern and we have now actually brought them into our European Science Exchange Programme as opposed to our East European Bilateral arrangements. The FCO was anxious to do something for Hungary, so we went to them and discussed what we could do. We meet regularly with the Minister. We discussed the possibility of a post-doctoral fellowship programme for young Hungarian scientists to bring them to this country as there was clearly a scientific need and a political need, and the FCO very generously funded half of this.

Chairman

238. Who funded the other half?

(*Professor Epstein*) We got it from a private foundation, it was conditional on that.

Lord Adrian

239. This was a happy occasion where two needs came together, it was more the resolution of potentially conflicting needs, conflicting judgments that concerned me.

(*Professor Epstein*) I do not think we have experience of that.

Chairman] It reminds me of the argument that the Navy always put forward, which was that the deterrent should not be charged to the Navy vote.

Lord Dainton

240. I wonder if I might raise one thing, which is the great deal of information covered in the section on evaluation. Turning away from the big science projects which are things that have to be negotiated beforehand, before they can be set up, very often they have to be internationally run, they often have international governing bodies, but I have got the impression from various sources that it is in some ways easier to get money for collaboration of small science groups in British universities, and, say, French, German, or Spanish universities, and at the end of the day, the general view is that the assessment of the project is often at best cursory. If one is asking in this context are we getting value for money there the answer might be no. Has the Royal Society got any views on the whole question of the evaluation of this relatively small science work

which is quite important and which has established some quite important roles of collaboration internationally in Europe.

(*Professor Epstein*) We do get feedback if we are involved in any way, however small, even if it is just to facilitate travel. For instance, we have, I am sure you all know, a big travel grants organisation for British scientists to go abroad. We do get feedback. People who go abroad on any of our programmes write and report and you get some sort of impression as to how it is going. A true retrospective scientific appraisal is a different matter; how do the research councils know whether their project and programme grants are really effective? This is one of the talking points going through the councils at the moment as to how to evaluate just that. There are all kinds of trendy bibliometric methods which seem to us rather unsuitable, but I do not know the answer.

241. I must not speak from my own experience too much but there is a sense, of course, in which a pound is a pound is a pound. If we spend it abroad we do not have it to spend here and, therefore, it is of interest to know whether the quality of work being paid for by these international agencies is as good as that which we have got at home. I have the feeling that is not true. I have heard that there are projects which have failed at home which are being taken in on the international net. I wonder if the Royal Society has any evidence or suggestions to remedy that.

Do you see the balance between internal and external exchange as being wrong?

(*Mr Cox*) There is one point here, Chairman, that is the European Commission funding is dependent on you taking another partner or preferably more than one partner in another country.

242. It would not be international if it was not?

(*Professor Epstein*) I think Steve is saying it is not bilateral, it is tri or multilateral.

(*Mr Cox*) That money is ear-marked specifically for that purpose. Funding for that is reviewed by the Commission rather than the international funding agencies concerned. Our concern about the European Community is their lack of peer review mechanisms to ensure that the science they are supporting is as good as the science the national funding agencies are supporting.

(*Professor Epstein*) This is exactly what you started with.

243. This is my point. There is a mechanism (I have just been involved in it) which I regard as very unsatisfactory.

(*Professor Epstein*) Yes.

244. I had a number of comments which came back to me and were not all that kind, there was not the opportunity for careful assessment.

(*Professor Epstein*) That is exactly the experience we have.

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Chairman

245. Would you think it is possible to judge generally, otherwise than in a specific case, the best way of carrying out the International Scientific Programme? You can have fully international laboratories like EMBL or you can have international co-operation in an existing national laboratory or you can have co-operation between people of different nations working in their own laboratories. Is it possible to generalise which one is better than another and can you, at the same time, comment on the advantages or disadvantages of hosting?

(*Sir Francis Graham-Smith*) It does depend what you want to do. I think we have set out a number of different purposes served by these programmes. Some are purely geographical, some are arranged so that the total is more than the sum of the parts but I was just thinking back to the suggestion that some of these programmes are not good value for money. I am not sure, I cannot think of any we have mentioned in this conversation so far that I would say were not good value for money. I think if I were looking for those which were not good value for money, I might look in the European Community ones because I know the review system there is not as strict as in this country.

(*Dr Collins*) If I can follow that and talk as someone with a professional involvement from time to time in the methodology of evaluation rather than someone representing the Royal Society view. I do not have hard evidence but I believe it is the case that, first of all, if you collaborate it takes more time than if you do it yourself. If you collaborate with a different country it takes even more time. So there is an overhead on international collaboration that you do not have on the national work, though you may reduce costs in other ways. So there is that, as it were, hurdle to overcome. There is the question of reviewing proposals rather than completed work and there is the third consideration in the European context that you have to marry scientific objectives in a programme with the political objectives of building up the social and economic cohesion of the Community which is why you have to have partners from other countries even if the project does not inherently demand it. If you take those factors into account I am not aware of any consistent evidence that international work is of any lower quality than national work. One could argue you have to be reasonably good to persuade somebody to work with you anyway.

246. Would you be in favour of perhaps having more of these entirely international laboratories, I think EMBL is one of them? Do you think they are a good thing?

(*Professor Epstein*) Not if they are going to do what is done equally well in national laboratories. There has to be a good reason for doing it. The motivation in some part for EMBL was to provide a training focus for people from many countries and

in that it has been very good. It is not very far from my own field in what it does and I feel that its work could be equally well done here at Mill Hill or LMB in Cambridge.

247. How about the advantages and disadvantages of hosting major international programmes?

(*Professor Epstein*) You are talking about bringing in the currency and providing jobs?

248. I am thinking of scientific advantages and the disadvantages?

(*Professor Epstein*) I think it is very good to have an international laboratory but any laboratory is, to some extent, international because people want to visit and work in it if it is good. Otherwise it has to have something special to make it worth setting up an international laboratory like EMBL. CERN is a different kettle of fish because that is something which no individual country on its own could afford to do.

Lord Dainton

249. One of the arguments for EMBL's expansion is we have to compete with the Americans. Is this a valid argument in science or not in this context?

(*Professor Epstein*) We have to compete with the Americans. Well, I would have thought LMB in Cambridge competes with the world.

250. Absolutely.

(*Professor Epstein*) I do not understand that particular idea. If you have something good it will compete. It is the fostering of excellence bottom up that the Royal Society is very keen on.

251. In that context—it is an answer to Lord Adrian's point—if you have political pressure it would be better to put our money into the LMB Cambridge laboratory.

(*Professor Epstein*) Yes.

Lord Nelson of Stafford

252. Should you not qualify that by saying "providing it is adequately funded"?

(*Professor Epstein*) Sorry, which bit?

253. The laboratory, you say if you have the right people you can compete.

(*Professor Epstein*) Yes but in fact LMB is one of MRC's five star institutions which suffer no cuts, come what may.

Lord Adrian] I would like to answer Lord Dainton's point, if that is the judgment of the research councils but not the judgment of somebody higher up that it would be better for international reasons to have an international laboratory somewhere else, how is that conflict resolved? I do not disagree with what you say.

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Chairman

254. Would you like to comment on the value of such things as ICSU, European Science Foundation and Academia Europaea?

(*Professor Epstein*) Let us start with ICSU, I have just come back from Bulgaria where we had the General Assemble of ICSU. There are two things which ICSU does which have to be done and which no other body could do, so in that sense you really do have to have ICSU. Those two things are, first of all, it does truly have an impact on ensuring the free circulation of scientists. It does affect the Japanese Government who demand a disclaimer on racism before you can get a visa to go there for an international meeting; it does have an effect on the trade unions in Norway who would not allow the South Africans to attend the international meeting on earth sciences. It does ensure that and it does have the power to make the point and see these discriminations are not allowed to affect international science. The second thing it can do is to co-ordinate big multi-disciplinary international programmes like IGBP. I cannot think of any other way that those two roles could be fulfilled. I do not know that if you want the details of what it does?

255. You reckon it is a valuable organisation, does it need improving in some way?

(*Professor Epstein*) It is always asking for more money. It seldom presents the detailed justification in a forward-look budget as to why it needs more money. It was extremely inefficient at the last General Assembly I went to where large numbers of people spent six and a half days, at great expense.

At least we have now got it down to three and a half days and the General Assembly will meet every three years instead of two. All these things are improvements and improvements the Royal Society has been pressing for very strongly. I was very encouraged. It does a good job, it does something that needs doing.

256. How actually is it financed, by individual governments?

(*Professor Epstein*) Not governments, adhering bodies. The Royal Society is the UK adhering body and the money which the Royal Society pays as the UK subscription comes out of the PGA—Parliamentary Grant in Aid—so it is government money for international relations.

257. How about the European Science Foundation?

(*Professor Epstein*) I know rather less about the European Science Foundation but I think Mr Cox can answer you.

(*Mr Cox*) I think the European Science Foundation too has a very important role in both co-ordinating, acting as a forum for European Research Councils and European bodies like that to get together. I think it has reasonably taken on a new activity which has proved to be particularly

successful—Networks Activity—which is doing precisely what needs to be done in Europe: getting enough scientists in the same field together in a natural scientific forum and then letting them get on with whatever it is they are getting on with. Those two elements do extremely well. It is quite a small organisation and is dwarfed by the Council of Europe, European Commission, or any major European institution, but it does have a major role for European science. I would say similarly for the Academia Europaea, for the individual scientists it should begin to perform that function as well.

Lord Sherfield

258. Can I ask about that? I do not know about Academia Europaea, where does Academia Europaea come from?

(*Professor Epstein*) It was the brainchild of Peter Brooke when he was Minister of Science. It was brought to life by the obstetrical cunning of the Royal Society which acted as a sort of midwife.

259. One of your predecessors.

(*Professor Epstein*) Sir Arnold Burgen is the President. Its main problem is that it is a financially sickly baby. It needs a big endowment foundation to take off, it is living hand to mouth. I think it is not unreasonable to say there is some hostility towards it on the part of national academies in European countries.

Chairman

260. Is it also financed by its constituent bodies?

(*Professor Epstein*) It is difficult to know how it is financed. The British Government actually gives it £65,000 a year by providing the rent for its premises here in Burlington Street. Apart from that it has a begging bowl going around the big European organisations and companies.

261. Perhaps they should apply to Sir James Goldsmith in his new role.

(*Professor Epstein*) They should put on a green hat before they go. We have switched from the European Science Foundation to the Academia Europaea, they are both good things.

(*Professor Epstein*) One is stronger than the other. We were midwives to both of them.

262. In some of the evidence we have had there was the suggestion, partly because links between science and industry in this country are not all they might be, that a lot of good British science is going, in fact, to help foreign firms. Do you know if that is the case and if so do you think it is true?

(*Professor Epstein*) I personally believe it to be anecdotally true but I do not have any firm information.

(*Dr Collins*) There is certainly anecdotal evidence. What happens if you are trying to get a

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[Continued

[Chairman Contd]

collaboration going between someone in an academic sector and someone in an industrial sector is that you look around for partners and the first person who bites the cherry, if he happens to be French, well he is French. There is a non-anecdotal aspect, if you like, if you are wanting to participate in a European Community programme, that requires collaboration not only between Member States but also at times across sectors. If you are trying to put together a consortium of five, six or eight partners to go in and if you are an academic in the UK, if you make sure one of the partners is a UK company which can then get involved in exploiting what comes out then UK Limited has more chance of benefiting. Again this depends on whom you know and what interest there is in your ideas.

Lord Dainton

263. Can I pursue this because this point has always been worrying, namely one has an international activity, CERN, and suppose in the course of that process of trying to keep these particles on the product you develop a coil for a super conducting tract which might be better, who has the right to that and how do the benefits of that flow back?

(Mr Cox) I cannot say specifically on CERN, CERN just might be different. The general principle is there will be an agreement between the parties that the intellectual property rights will be shared equally among the partners contributing. We make sure any programme we are involved with—

(Professor Epstein) We being the Royal Society.

(Mr Cox) Any scientist involved in international collaboration makes it absolutely clear to their partners that any benefit will be shared equally and shared equally means with regard to the financial input of the programme.

(Dr Collins) CERN is in many ways a case unto itself. In answer to the generality of your question, SEPSU has done a lot of studies on R&D collaboration in Europe and in Japan. We have talked to a lot of companies and individuals that have been involved in this. It came as a surprise to me that the one problem we did not find was intellectual property because that is the one everybody knows about and they make jolly sure that one is thrashed out before they start. We have come across very little evidence it is a problem. It is only a problem if you give it a chance.

Lord Sheffield

264. You say on paragraph 10 of your memorandum: "The Treasury rules on additionality, however, are more pernicious." I think another Select Committee have gone into this in some depth and would certainly, I think, subscribe to that although I do not think they used that adjective. It is a very complicated subject to have studied, but have you any suggestions or ideas as to how, in what way, these rules could be modified or made more egalitarian?

(Sir Francis Graham-Smith) I do not see why the rule has to apply. The EC has its funds available and it has its own methods of distributing them. It does not seem reasonable that any particular distribution that the EC decides to make would reflect, pound for pound or ecu for ecu, into the research council to whom that activity might have been attributed in this country. It seems to be a stultifying position which will, of course, discourage the relevant research council from supporting the activity in the first place.

(Professor Epstein) It is a bit like the illogicality, is it not, of allowing research councils now to provide overheads for universities for work that has to be funded whereas there is no provision for any recompense for say the medical charities. It is a similar kind of discrepancy in a sense.

Chairman] Thank you very much. I think we will have to wait and see how the Treasury reply to the criticism which this other Committee has made of them.

Lord Kirkwood

265. Can I just ask a short question which comes back to the standards of EC funded research. The very fact that there are so many alpha rated projects submitted to SERC which are not granted means that young researchers are forced to look elsewhere for funds. Therefore they are attracted to EC research projects but because of inevitable compromise and inadequate peer reviews, the standards are lower. Is this not a very invidious situation where young researchers are, because of lack of funds in this country, driven to undertake poorer quality research with funds from the European Community?

(Professor Epstein) The question of responsive mode grant funding by the research councils is something which has gravely concerned the Royal Society Council for three years now and at the last meeting a statement was agreed that Council will put out about the lack of responsive mode funding. It is an extremely serious situation. I doubt whether young workers who are the worst hit are able very frequently to go to Brussels to get funding because of the administrative and bureaucratic difficulties. It is one thing for a head of department to fight his way through that but a newly appointed lecturer is not likely to.

266. He may be fairly desperate for research funds.

(Sir Francis Graham-Smith) I do not think we have any evidence for the lowering of standards in those circumstances. There is a very large subscription, twenty times over-subscription on some projects, so I think we have no evidence there is a lowering of standards because of that transfer of allegiance.

267. It has been stated in written submissions that a great number of compromises are needed in formulating ISP projects to fit in with so many

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[Continued]

[Lord Kirkwood *Contd*]

partners. This inevitably, I would suggest, leads to a poorer quality of research. In your submission you state that there is less control over the agenda and less flexibility to adapt to changing circumstances than in a national programme. Researchers are stuck with a programme, and must proceed to the bitter end.

(*Sir Francis Graham-Smith*) It is hard for us to judge this because I do not think we have sufficient direct evidence of how the decisions are made.

(*Professor Epstein*) We do not see this. It is one of the things we are learning about.

Chairman

268. Would you be in favour of abolishing the European framework programme and putting that money into a British programme?

(*Professor Epstein*) If it would help British science out of its lamentable state, I would.

(*Sir Francis Graham-Smith*) I would not because there are some services which the European Community can perform which other countries cannot perform nationally.

Lord Nelson of Stafford

269. Is the main message we show take from the Royal Society, their number one recommendation, namely in view of all the difficulties we have touched on, you recommend HMG establish a standing group to advise it on any emerging International Scientific Programmes?

(*Professor Epstein*) I would prefer the word "focus" because that does not prejudice whether it is as an individual or what it is but there should be some conductor for the orchestra.

Chairman

270. Which in practical terms would be based on ABRC or the Cabinet Office?

(*Professor Epstein*) Exactly as we stand now, yes.

271. Thank you very much indeed, Professor Epstein and your colleagues for the extremely helpful evidence to us which has cleared our minds and can be described in diplomatic terms as a free and frank exchange of views.

(*Professor Epstein*) Thank you for letting us come, Lord Chairman, and being so patient with us.

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TAKEN BEFORE THE
**SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY**
(SUB-COMMITTEE II)

Thursday 25 October 1990

SCIENCE AND ENGINEERING RESEARCH COUNCIL

Sir Mark Richmond, Mr J R Merchant and Dr A E Hughes

NERC

Dr E Buttle, Professor J C Briden and Professor P Liss

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THURSDAY 25 OCTOBER 1990

Present:

Adrian, L	Lewis of Newnham, L
Carver, L (Chairman)	Nelson of Stafford, L
Dainton, L	Nicol, B
Flowers, L	Shackleton, L
Kirkwood, L	Taylor of Blackburn, L

Memorandum by the Science and Engineering Research Council

EXECUTIVE SUMMARY

The SERC is actively involved in international collaboration and bases its participation in international scientific programmes primarily on scientific criteria. Increasingly, world class science will depend on access to large facilities or programmes beyond the scope of individual countries. The Council believes that there are significant advantages in hosting large facilities and regrets that the Government do not share this view. The Council wishes to participate fully in European Community R&D programmes and hopes that Treasury rules on attribution will be interpreted flexibly with regard to timing and incidence in order that distortions of priorities do not occur.

PREAMBLE

The Science and Engineering Research Council welcomes this inquiry into an issue of growing importance. The Council believes that given stronger and more active political leadership the UK could derive greater benefit from its investment in international scientific programmes.

INTRODUCTION

2. The Science and Engineering Research Council is the largest of the five UK Research Councils (1990/91 budget) supporting basic and strategic research and research training in all the fundamental disciplines of science and engineering except those covered by the other mission-oriented Research Councils. It gives this support by:

- (i) the award of research grant to individual scientists in universities and polytechnics (c. 38 per cent);
- (ii) the award of research training studentships and fellowships (c. 17 per cent);
- (iii) the provision of major central research facilities and services for use by academic scientists in UK and abroad and industry (c. 20 per cent);
- (iv) the adherence to international facilities (e.g., CERN, ILL, and more recently the European Synchrotron Radiation Facility, ESRF) and organisations (e.g., the European Space Agency) on behalf of UK scientists (c. 22 per cent);

3. The Council has always supported international collaboration for the benefit of UK science: both through the support of informal collaboration between individual scientists and their colleagues around the world and, by contributing to major international facilities or scientific programmes whose costs were beyond the resources of any individual nation. Roughly one quarter of the Council's budget is spent on international collaboration in one form or another, formal or informal. All forms of collaboration have increased in recent years, partly in recognition that the UK needs access in other countries science in order to compete internationally; and because of the increased sophistication and cost of the facilities needed at the cutting edge of science. Thus while we could afford to build our own synchrotron radiation source (SRS) at the Daresbury laboratory, the next generation of much more powerful source will be a collaborative European venture (ESRF) in Grenoble. Similarly, we have increasingly attracted overseas partners to share the cost, and scientific benefit of our own national facilities, such as the major telescopes and the spallation neutron source ISIS. The last we understand to be the national facility with the highest international investment (around 22 per cent) in the world.

4. The Council participates in a wide range of international scientific programmes from major intergovernmental treaty organisations providing major facilities such as CERN and the scientific programme of the European Space Agency; inter-agency agreements with analogous overseas bodies on the shared use of research facilities; to informal collaboration between scientists supported nationally by the Council's own schemes, or by international agencies such as the European Science Foundation.

5. The following paragraphs respond to the specific issues raised in the Committee's letter of 8 June. Because of the range and variety of the Council's international activities it is difficult to give a single answer in many cases, but an attempt has been made to generalise and summarise the Council's experience for the Committee's benefit.

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- (i) the advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions;**

Response

The Council's objective in joining ISPs has always been, and remains, benefit to UK science. The scientific advantages of joining an ISP are to gain access to a wider body of scientific knowledge or expertise than is available nationally; to undertake research which would be beyond the resources of an individual country (e.g., particle physics, space science); to operate in geographical locations of scientific importance (e.g., our telescope in Hawaii and the Canary Isles); and as a part of training to expose young scientists to wider and different scientific systems and cultures.

The advantage to the funding department is usually, but not always, a financial saving.

The disadvantages of participating in an international scientific programme are the partial loss of control and inevitably more complex decision making involved.

- (ii) the advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution;**

Response

The advantages to the UK generally of hosting a large facility are the greater influence on its scientific and general administration and the indirect benefit to the country of the scientists who are thereby required to come here. The local economy benefits from the economic activity generated. UK scientists are spared having to travel overseas to use the facility. Local/national industry can benefit from contracts let. Subscriptions to the facility can be paid in the local currency avoiding exchange rate problems.

The main disadvantages are the added administrative burden on the host institution, and the loss of use by UK scientists.

- (iii) the machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate;**

Response

- (iii) 1. Practice varies so much in the initiation and setting up of international programmes that only certain generalisations with examples can be given.
- (iii) 2. The most successful international programmes are those which arise from a common perception of a need to collaborate by scientists (or scientific organisations) in several countries. This can arise from the need to share the cost of major new facilities. As an example the European Synchrotron Radiation Facility (ESRF) now under construction in Grenoble arose out of discussions between scientists in the European Science Foundation (ESF). More recently active discussions are under way between the key agencies in UK, France, FRG, Italy and Spain on the construction of a European high performance laser for civil scientific research whose cost would be well beyond the resources of any single European nation, but which will be needed if European research is to keep pace with the US and Japan.
- (iii) 3. In scientific fields not requiring capital intensive large facilities, scientists can want to collaborate in order to pool intellectual resources, and by adopting complementary approaches to a particular topic develop a more rational distribution of effort. The European phrase used to describe the approach is "actions concertées" or concerted actions. Such an approach requires neither major central funding nor significant bureaucracy. The Associated Activities and Networks of the ESF are good examples of this approach. The work of the international scientific unions under ICSU leads to this approach. In recent years a number of informal groupings have arisen with similar objectives such as the Anglo-Franco-German grouping on transition metal proteins; a committee on nuclear (medium energy) physics (NuPECC); in Mathematics EUROMATH; in general chemistry the Committee of European Research Council Chemistry Committee chairman (CERC3); and in materials. In all these cases, the research costs themselves continue to be borne by national agencies. SERC believes that this is a particularly cost-effective means of initiating and developing international collaboration.
- (iii) 4. In the Council's experience international scientific programmes launched at political level, with a political motivation, are less successful and less easily developed and managed. A particular recent example of this has been the Japanese inspired

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international Human Frontier Science Programme. The first proposal for this was made by the Japanese prime minister at a Summit meeting, but it subsequently became clear that, apart from a general political desire to increase their level of involvement in international collaboration, the Japanese had few practical proposals to make and little idea of what was involved in launching a major new international programme. It subsequently took several years of prolonged discussion and international negotiations in which the UK was very active to develop a practical scheme—with a secretariat headed by a UK scientist Sir James Gowans. Even now however the means and level of UK financial contributions are under debate since the funding agencies concerned (MRC and SERC) are effectively being asked to contribute from their own research budgets to an international programme which is not of their making nor directly accountable to them.

- (iii) 5. The research programmes of the European Community share some of these problems. Although the Research Councils in recent years have been more active in influencing the content of EC R&D programmes, such programmes are ultimately decided at political level—in the EC Research Council of Ministers—in which political considerations inevitably play a role. The cost of such programmes is however borne indirectly *via* attribution to the appropriate Whitehall Department even though that Department was not represented at ministerial level at the relevant Council. To date the Science Budget has not been significantly affected by attribution, but this will come with the new Framework programme. The net effect will therefore be that the Science Budget, and the Research Councils will be obliged in the end to pay for international research programmes over whose level and content they have no direct control.
- (iv) **The technical and financial criteria under which proposals for ISPs are presented and considered;**
 - (iv) 1. SERC's overriding criterion (as mentioned in (i) above) is benefit to UK science. Technical and financial criteria for participation in ISPs depend on the nature of the programme in question. Technical criteria centre round the two questions:
 - (a) —is this a programme in which the UK has particular scientific skills or technical expertise to *contribute*? Where programmes include central funding (e.g. EC R&D) this will mean that UK scientists will be in a strong position to bid for grants or contracts.
 - (b)—is this a programme from which UK scientists will *derive* scientific benefit in collaborating? i.e., have the other countries/agencies concerned got skills or expertise from which we can learn;
 - (iv) 2. Financial criteria are essentially those of cost benefit, namely:
 - (a) —would participation in an international programme allow research to be done which we could otherwise not afford? (i.e., cost sharing of big facilities);
 - (b) —would participation at a given level of resource produce a greater scientific return than spending the same resource purely nationally? (the concerted action model).
 - (iv) 3. More detailed criteria include:
 - the degree of control over capital and operating costs, budgets,
 - management structure
 - flexibility
 - fixed duration commitment
 - provision for regular monitoring and review
 - provision for early termination
 - provision for unilateral withdrawal
 - means of calculating contribution (e.g., GNP or other formula, or *à la carte*)
 - currency in which contribution to be paid
- (v) **the forums in which the decision to participate in ISPs is normally reached;**
 - (v) 2. This depends very much on the nature and scale of the programme involved. At the lowest level, the decision to participate may be considered and reached wholly in the appropriate grant-giving body (Subject Committee) of the SERC which has delegated powers up to a certain level. This would apply to the scientific programmes of ESF (funded on *à la carte* basis), or to specialist activities such as the international Centre European de Calcul Atomique et Moléculaire (CECAM). A number of technical agreements for the supply or receipt of equipment, or the provision of beam time on facilities are negotiated and concluded directly by the Council's establishments. At a higher level the Council itself or the Chairman has to approve participation in larger programmes such as the general budget of ESF or the European Incoherent Scatter Scientific Association (EISCAT) with France, FRG German, Norwegian, Swedish and Finnish Research Councils for the provision of ground based radar to study the ionosphere.
 - (v) 3. Where more substantial resources, or political considerations obtain, the Council needs to work with overseas partners under an intergovernmental agreement. The most

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significant of these are CERN, the European Space Agency (science programme), the Institut Laue Langevin, the Anglo-Australian Telescope, and the European Synchrotron Radiation Facility (ESRF). At the lowest level, this involves clearance with the Department of Education and Science (DES) at official level. Where circumstances demand, as was the case with the ESRF, Departmental Ministers are informed or consulted and may play a role in discussion or negotiations with their opposite in other countries. They will also consult Ministerial colleagues in other Departments directly involved, such as FCO and Treasury.

Other countries may also choose to make representations to the UK at Ministerial level. This was done, for example, by the USA in their mission to gain international support for their SSC (super-conducting super collider) high energy physics project.

- (v) 4. Ultimately issues with major political implications such as UK membership of CERN, or the level of resources for the science programme of ESA or EC.R&D require inter Ministerial discussion at the highest political level, and can also be subject to advice from senior advisory bodies such as ACOST. At these levels, the closest possible interaction is necessary between the Council and Departmental officials.
- (vi) **Government practice and guidelines on ISPs—how they apply and how widely they are known and accepted**
 - (vi) 1. The Government do not issue any published guidelines on international scientific programmes. A series of guidelines for internal use was however produced by the Cabinet Office in consultation with Departments last year; and endorsed by Ministers. Those guidelines were drawn to the attention of those in SERC with responsibilities in this area.
 - (vi) 2. The major problems in practice of Government involvement in ISPs are:
 - (a) a political inclination to prefer responding to the initiatives of others (e.g., French initiative on EUREKA; Japanese initiative on HFSP), rather than to take initiatives
 - (b) an attitude to public expenditure which requires immediate short-term benefit to be demonstrated rather than taking a longer-term view of investment (as the Japanese do);
 - (c) the difficulty of interacting with international programmes where two or more Government Departments are involved, in the absence of a single Minister with an overall S&T portfolio.
- (vii) **Treasury rules of additionality and attribution—how they apply in respect of ISPs and the Science Budget and how they treat inflow of foreign money;**
 - (vii) 1. Our understanding is that Treasury rules on attribution and additionality apply only to European Community programmes. To date attribution has only marginally applied to the Science Budget. More substantial attribution (in the order of several millions of pounds) is expected following the Government's agreement the EC Third Framework Programme which contains several Lines on which DES agreed to take the lead—and hence bear the attribution. The precise level of attribution and the method of application were, at the time of writing (July 1990) still subject to Ministerial discussion.
 - (vii) 2. SERC accepts the logic of the Treasury principle of attribution as a means of exerting overall control of public revenue. It is concerned however on three main counts:
 - (a) the level and content of EC R&D programmes for which the Research Councils will have to "pay" via attribution is determined by a political process in which the Councils have no direct involvement (unlike the national process in which the Councils determine the level and content of their own programme within overall budgets determined by a political process).
 - (b) as a result, if applied inflexibly and without time for adjustment, the system could result in the Council involuntarily and indirectly supporting (via attribution) research programmes of lower scientific priority than it would choose to support direct from its own budget.
 - (c) UK research is put in a weaker position compared to its European competitors who do not operate under the same system.
 - (vii) 3. The inflow of money to SERC is reported in the course of preparation with DES of Parliamentary Estimates and reported to Parliament as Receipts in the published Estimates. We have no evidence that the Department or the Advisory Board for the Research Councils (ABRC) has to date taken these receipts into account in setting the level of the Council's Parliamentary Grant in Aid.
- (viii) Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions;
- (viii) Major impediments affecting SERC's involvement in ISPs are:

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- (a) *Currency exchange rate fluctuations*
- (viii) 2. Unlike most of its European counterparts, the SERC has to bear the full cost of currency fluctuations for international subscription from within its own cash limited budget. In France and Germany for example the costs of major international subscriptions are borne on separate budgets. The problem is particularly acute for SERC for the CERN subscription (£51.3m in 1990), the cost of which to SERC rose by about one-third in real terms three years from 1985 to 1988. These increases can be borne only at the expense of other areas of research which are not necessarily of lower scientific priority. It was this conflict which led SERC and ABRC to commission the Kendrew Report on High Energy Particle Physics which recommended that the UK should remain a member of CERN only if the cost could be reduced by 25 per cent.
- (viii) 3. A policy of forward buying of currency, and some relaxation of the hitherto very constricting rules on carry-over of funds from one financial year to the next have slightly alleviated this problem, but it remains the largest single difficulty for the Council.
- (b) *Attribution*
- (viii) 4. The Treasury practice on attribution acts as a deterrent to SERC promoting increases in Community R&D programmes. On the other hand, once such programmes have been agreed by the Council of Ministers the fact of attribution acts as an **incentive** to SERC to be active in bidding for EC contracts and grants.
- (c) *Government attitude to hosting facilities*
- (viii) 5. The Government believe that in areas of high/full employment there is no economic benefit to the UK from the hosting of international organisations or facilities. The Council disagrees. (In the case of CERN, apart from the benefit of the majority of salaries being spent in France and Switzerland, the Swiss make a contribution of 4 per cent but get nearly 30 per cent of the total orders for contracts placed by CERN; the French were prepared to pay a 10 per cent site premium to the construction phase of the European Synchrotron Radiation Facility being built in Grenoble. For the future proposed Gravitational Radiation Observatory, not only has the Federal Research Ministry been prepared to offer a larger proportion of costs, the local Land government is also expected to make a substantial contribution in cash and in kind in order to have the facility sited there.) As a result of the UK Government's view on the benefits of hosting facilities, however, they are not prepared to provide significant incentives to attract facilities/organisations to the UK, while other countries are more forthcoming. The Council believes that over time the UK suffers scientifically and economically from this attitude.
- (d) *Ministerial responsibilities and attitudes*
- (viii) 6. Divided Ministerial responsibilities for certain international activities (such as ESA, EC R&D), against a background of tight budgetary policy, and a perceived lack of Government interest in developing closer European Community ties, tend to work against the interests of UK scientists seeking to collaborate in Europe.
- (e) *Domestic/personal issues/language*
- (viii) 7. These factors appear to have less influence on research scientists who are highly motivated to work overseas than on technical support staff, for whom there is less incentive to overcome the inevitable domestic and practical drawbacks.

Representation in Whitehall

- (viii) 8. As a non-Departmental public body (NDPB) the SERC and other Research Councils is not directly represented on the senior official interDepartmental committees which formulate policies on international scientific collaboration, but is represented by DES officials who are also expected to represent the interests of the other four Research Councils and the Royal Society as well as the entire academic scientific community employed in UK universities and polytechnics. This is despite the fact that SERC alone spends more annually on R&D than any civil Department (including DTI) and the Research Councils and UGC combined spend more than 30 per cent of total Government funded R&D, and 40 per cent more than all the other civil Departments combined (£1.4bn in 1987-88 as compared to £1.0bn).
- (viii) 9. SERC believes, on these grounds, that it should be represented directly on all senior interDepartmental discussions on international where its interests are involved.
- (ix) **impediments in other countries to their engaging in ISPs (EEC; Commonwealth; USA; Eastern bloc) e.g., concern with national budgetary procedures.**
- (ix) 1. SERC is not well qualified to comment. In general SERC collaborates in areas of openly published basic science in which questions of IPR, protectionism, do not bear too heavily. Until recently the major impediments to free international collaboration were those political constraints experienced by scientists from the centralised economics—mainly the former Eastern bloc. The lifting of those constraints has opened

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unprecedented opportunities for collaboration with countries such as Hungary, Czechoslovakia and Poland, as well as the USSR whose scientific potential has been held back.

Their main impediments now are lack of good equipment in many fields, and lack of convertible currency with which to purchase it and to travel.

- (ix) 2. We would start from the assumption that any participating country or organisation will give primacy to national benefit, as SERC does. On specific countries, the USA has traditionally not been an easy partner in collaboration because its pre-eminent position lead it to expect to dominate. As it starts to feel threatened by Japan on the one side and a reinvigorated Europe on the other, it is suffering some tensions between internal protectionist political forces and the natural desire of its scientists to collaborate openly.
- (ix) 3. The Japanese have been relative latecomers to the international science scene, and sometimes have not found it easy to adapt to some traditional and cultural attitudes to the normal informal free flow and intellectual currency of international collaboration in basic science. In general however this has not affected SERC relations on the development of SERC supported collaboration with Japan.

Examination of Witnesses

SIR MARK RICHMOND, Chairman, MR J R MERCHANT, Director (Council Policy and Administration), and DR A E HUGHES, Director (Laboratories), SERC, called in and examined.

Chairman

273. Sir Mark, we are most grateful to you and your colleagues for coming along and giving us evidence and helping us with our study today. We are extremely grateful for the very clear written evidence which you gave us. I think it might be helpful to us if, before I ask you to introduce your colleagues and make an opening statement, I just try to summarise the main theme of the evidence we have received already. First of all, dealing with big top down international scientific programmes, we have had the complaint from the Royal Society and others that there appears to be a sort of vacuum at the top so that it is very difficult to get rapid and easy agreement if more than one department is involved, certainly if more than one research council is involved; and that there is a serious lack of some co-ordinating body to grip the suggestions which come from outside in these big international ones, in which governments are involved. That really is the first point I hope you will be able to cover. The next is the bottom up one, in which a wide amount of evidence from a lot of different people gives us the impression that it is very difficult, when you get to the stage of having collected the people who want to co-operate together internationally, getting the thing going. An awful lot of people do not seem to know how to set about it. When they have spent a lot of time going round trying to find out about how to set about it enormous delays are then involved both in getting approval and certainly in getting funds. That varies from quite small projects to quite medium sized projects. The third main point is all this talk about finance, particularly connected with the European Framework Programme. We would be very grateful, either in a statement or in response to questions, if you would tell us what you think about how the arrangements for financing international programmes now work or do not work, and how you might think they could be made to work better? Those I think are the three major issues that seem to be coming up from our evidence.

(Sir Mark Richmond) Thank you, my Lord Chairman. Mr John Merchant, on my left, is the Director of Policy and Administration in SERC; and Dr Tony Hughes, on my right, is the Director of Laboratories. He has had quite a lot of experience with some of SERCs big projects over recent years. Perhaps if I took your points in reverse order and began with the finance, within which I encompass the attribution and additionality problems which pre-occupy us and I think pre-occupy you—if I have understood some of the records of your deliberations. I think we are concerned about that aspect of things because it is partly unclear to us exactly how the process works. More particularly I think we are concerned because we believe we may sometimes find ourselves in the position where courses of action, agreed and accepted by others, then fall to us to implement. We are concerned that we may not necessarily have been, in our view, sufficiently involved in making the decisions in the first place; and we may find ourselves from time to time involved in, as it were, picking up the tab for the decisions of others. If I can focus it down in terms of one of the Framework Programmes—and the third one is brewing soon. In it there is one line (it is not yet finally agreed) which may affect us very directly. It is the Line 6 programme on mobility. There the DES will take the lead and decisions in Brussels will be taken as to the amount of money which will be allocated to that particular programme. Those sums of money, under rule 1 (which is basically that extra money will not be printed just because of the decisions in Brussels), will be attributed within the DES and then by the DES in the various programmes that they fund. Another attribution may lead to the amount of money coming to ABRC being top-sliced actually to accommodate that programme. It is of course up to British scientists then to bid for money under that programme. If the succeeded the resources come back, but in terms of the bids that will be made, and the areas that will be supported, they may well have been decided without, in our view, adequate discussion with us as to what we really want to fund. At the end of the day,

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nevertheless, it is debited against our account. We feel there is an open area here where there is inadequate linkage between SERC and its aspirations, and what may be attributed to us. Then, when the programme is underway, there may have been various reasons for extra spend being incurred. This is again, under rule 1 (pound notes not printed), where the question of additionality comes in, and you may have a further tax placed on you. Yet you may be a rather passive partner in deciding where that tax lies. That is my understanding of the situation. It has to be said that on top of everything else there is a certain unclarity as to how precisely the situation develops and is operated. I think I am right in saying that the DES have not been involved in this substantially if at all, up to this point. Most of the attribution and additionality that affects us has been through the DTI.

(*Mr Merchant*) The DES has not had attribution up until now, and additionality has not applied to the science base.

(*Sir Mark Richmond*) We are concerned about how it will work.

274. Have you got proposals as to how it might work better?

(*Sir Mark Richmond*) I think we start, as I think we said in our written evidence, from an acceptance that extra money cannot be printed, that basically the costs of all these programmes have to lie within the budget; that we are not contesting. What we are concerned about is the extent to which we have input into the decisions. The DES may well, as I understand it, top-slice the ABRC budget before it ever gets to ABRC. It may occur within the portals of the DES and we may have no say in that. The programme against which that sum arises will have been discussed by civil servants in Brussels. Again, we may not have had a major input into what the programme may contain.

Lord Dainton

275. Through you, Lord Chairman, may I ask whether any advice is given to those DES officials before they go? Are they influenced by the ABRC?

(*Sir Mark Richmond*) I think the answer is yes, they are influenced. We do have informal contacts—I think there is even more than that: we can certainly put in a view. It is a very active matter at the moment in relation to Line 6 in the Third Framework Programme where a view is being pressed in Brussels and we know that the United Kingdom Government has reservations about it; and we have put in a view. But we have yet to be assured, I think, that enough notice is taken of us—let us put it that way.

276. Is the lack of notice taken as between the scientists within the Research Councils or ABRC and DES or between DES and Brussels?

(*Sir Mark Richmond*) I do not know if Mr Merchant could answer that. He has seen some in the past in relation to DTI.

(*Mr Merchant*) I think there might be a measure of both. There is certainly a difficulty in pressing the United Kingdom case in Brussels. The Commission is incapable of meeting all the aspirations of all the countries of the Community, so success is not always to be expected. There is also some difficulty in getting our views properly put forward in the debates between our representatives in Brussels and the Commission.

Lord Flowers

277. I am not absolutely clear from what has been said—the use of the words “we” and “us”, and things like that—the extent to which SERC itself can press its case. At what level can you on these matters go to Brussels yourself, or do you have to operate through the DES or through the Treasury, or what?

(*Sir Mark Richmond*) I think it is fair to say—I will ask my colleagues to confirm this—that we can go to Brussels and make representations ourselves in Brussels. I think there may be opportunities to go in the entourage of the lead department, but I think a closer coupling than that does not occur. I have to say that, as far as the DES is concerned, we are entering new territory. The Third Framework, I think, will be the first time, as far as SERC is concerned, that such discussions have actually taken action.

278. One cannot expect your view always to prevail. One can hope your view is put properly. (*Dr Hughes*) Chairman, we do have as much access to Commission officials as we care to obtain and can manage through arranging appropriate communications and meetings, so I think we certainly do have the ability to make an influence through that channel. But, of course, that is not the official channel through which actual decisions are made. I think what tends to happen in practice is that, whilst we do get asked for our views, we are never sure to what extent those views are able to get through and be voiced because the chain is quite a long one sometimes. Perhaps more importantly, we often do not have a great deal of time to formulate those views against specific questions, so that in practice it is very difficult, if not impossible, for us to involve our peer review system very much in formulating reactions to movements that may occur in the position in Brussels.

Chairman

279. But this is relating purely to the European Framework Programme at the moment?

(*Dr Hughes*) Yes.

280. Relating to, as it were, the initiation of a general programme or to the review of specific projects within that programme?

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(*Sir Mark Richmond*) It is primarily to do with the way in which programmes arise, the way in which their costs are subsequently charged out and the extent to which we have to pay for what we are not primarily involved in reaching a decision about.

281. Apart from hoping that the DES or the officials either of the DES or of the Commission would listen more carefully to what you say, are there any institutional frameworks you think would help in this or do you think the whole system should be changed? What I have not yet found in all this discussion is anybody who is proposing anything different other than that somebody else should pay.

(*Sir Mark Richmond*) I think that was not so much in my mind. Actually I am much more concerned about being party to the decision and actually thereby, as it were, being more accountable for the way in which money is subsequently spent as a result of the decision. I feel at arm's length to a lot of these decisions.

282. How could you institutionally see that that was better done?

(*Sir Mark Richmond*) What I am not clear enough about is the way in which departments of government actually handle the question of allocating the charges that arise and actually negotiating the contents of programmes. As you will realise, I am new in the job. My colleagues may have experience of discussions that have led up to the Third Framework Programme and Line 6. I do not know to what extent we have been formally involved in that.

(*Mr Merchant*) One of the difficulties we have is that the final decisions about Community programmes are made in the Research Council—by that I mean the EC Research Council—and the UK representative there is one of the Ministers in the DTI, not a Minister in the Department of Education and Science, so that our effect is therefore rather distant.

Lord Lewis of Newnham

283. If I understand it correctly, your problem really is twofold. Firstly you are not there to be involved in the direct decision but secondly you have the foundling left on your doorstep. It may not have the priority you would like put in view of your own programme. In general terms when you find you have to make a cut of this form and you itemise at least four areas in which you have actually made allocations, which is the area that is most sensitive and most likely to be cut?

(*Sir Mark Richmond*) That, of course, is a question directed to what is the process for resource deployment in the SERC. Do you agree that is the question?

284. Yes.

(*Sir Mark Richmond*) Of course, it takes us immediately into the area of concern with your

Committee because it leads into consideration of the flexibility of spend in the Council and its large-scale commitments; and large-scale commitments very predominantly are commitments to big international programmes.

Lord Nelson of Stafford

285. You said you felt you were at arm's length to the point of decision. Let me ask for clarification, arm's length to whom, to where?

(*Sir Mark Richmond*) As I think was made clear, the decisions were actually made in the Council of Ministers by the Ministers supported by the civil servants and the department. We are not civil servants in the department and I think we do not go to those meetings.

286. That is only in relation to EEC programmes?

(*Sir Mark Richmond*) Yes. We are talking specifically about the attribution of funds allocated under the EC.

287. Do you feel equally at arm's length on others?

(*Sir Mark Richmond*) No, because we are frequently spending our own money. If you take one example right out of the air: our contribution to the Anglo-Australian telescope is our money, part of our vote and I am the accounting officer. We make the decision and we pay up. We are very, very tightly coupled into that.

Lord Adrian

288. There are some where you are not, for instance, the HFSP which you mention in your evidence. That, I take it, was a decision by the Government, by the DES—I am not quite sure—after substantial discussion with SERC and the Research Councils?

(*Sir Mark Richmond*) That is right. There are a very large number of different kinds of arrangements. Another with which Lord Lewis is familiar is the relation to NATO where the SERC budget was raided, to the tune of £2 million, and that sum allocated to the Foreign Office. They deploy it and we win some of it back; but the important thing there is that some is used to appoint fellows and we are actually the people who decide whether the fellow gets the fellowship or not, so the development comes back into our hands.

Lord Taylor of Blackburn

289. To go back to Lord Lewis's question to you, which is the most sensitive area? Which would you drop?

(*Sir Mark Richmond*) This is the other big question which I think must interest you, it certainly interests us: the extent of the flexibility in the deployment of resources by the Research Councils.

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Everything depends on the magnitude of attribution. Some of these programmes are very big. If the attribution for the programme is large, you immediately have to seek resources and that can be difficult as a very great deal of our resource is locked up in big programmes. Take the CERN commitment of SERC: that is a sum of rather over £50 million a year and that, out of a budget of about £450 million, is a sizeable sum. Because of the constraints that surround it, basically a matter of contracts, you are pushed to seek adjustments in the other parts of the programme; and there can be areas which you may not want to adjust. Your Lordships may turn round and say "That is your fault for getting into the international agreements in the first place"; and I say, in that context, we should perhaps discuss—this is another of the questions—how one gets into these big arrangements. The thing that bedevils them is, having entered the contract, that not everyone has perfect foresight and that you find yourself a few years down the road with a very large commitment and a changing backdrop; but nevertheless you're confronted with a commitment. You might say you should not have entered into those commitments but it is not very easy to have hindsight.

Chairman

290. Do you therefore agree with the Royal Society that there is some form of lack of a co-ordinating body at the top, or what co-ordinating body there is not doing its work properly? There is the Chief Scientific Adviser's Secretariat in the Cabinet Office, there is the ABRC and the Royal Society themselves who are to a certain extent involved in this. If you want to improve matters, is it a question of just trying to sort out with the Treasury the rules about attribution or is it a lack of proper machinery at the top for dealing with these major problems which leave you in the end with major financial commitments or is it just that the existing machinery is not working as it should work?

(*Sir Mark Richmond*) I think, on the rules on attribution, the Treasury may say that they are already worked out and clear. I have read the evidence they gave to you and I have to say I was not clear, but perhaps you are wiser than I am in understanding what they were saying. I think the problem centres around this question of the commitment: the responsibility, the involvement of independent bodies such as the Research Councils, in generating the programme. We ourselves have to be clear when we are entering into a contract what the terms of that contract are.

291. What you are talking about now is solely the European Framework Programme?

(*Sir Mark Richmond*) I am talking about any international programme. We enter into a contract and we ourselves have to be clear about the terms of the contract.

292. Can you give an example of a major international programme which is not a European programme —

(*Sir Mark Richmond*) Yes.

293. — Which was landed on your plate, as it were, without your being fully consulted and without you feeling this was a commitment you were happy to take on.

(*Dr Hughes*) I think that our concern is in the European Community context, because the other major international programmes that SERC is involved in, one way or another, are all ones that the Council made decisions on itself, albeit in some cases a long way back in time.

294. Leaving aside the European Framework Programme, you do not complain that there is a vacuum in the organisation, but on proposals that come from elsewhere, or decisions about taking part in major international programmes which are not Framework Programmes, you are happy that that machinery works satisfactorily?

(*Sir Mark Richmond*) Particularly since the rules for delegated authority were recently very much expanded, and we now have delegated authority to spend —

(*Mr Merchant*) — up to £20m capital.

295. You have no complaints on that score?

(*Mr Merchant*) No. I think, my Lord Chairman, we would be rather concerned to see a further level of bureaucracy put into the system somewhere.

Chairman] The Royal Society complaint was that the machinery was not working properly and that they were not represented in it. That was their main problem.

Lord Flowers

296. The Royal Society have made a rather serious charge and have said that things start off by scientists talking together, and at that stage everyone knows what is going on, and then somehow it gets into more official circles and nobody knows what is happening until something comes out of the machine, maybe some years later, when everybody is told what they have to do. This is the missing piece as far as the Royal Society sees it. You could say, "You are part of the machinery and know perfectly well what is going on".

(*Sir Mark Richmond*) With all respect to the Society, which both of us belong to, they do not actually know terribly much about what is going on. If you take, at the moment, our proposals to build a large optical telescope, it seems to me that every single member of the astronomical community in the country knows in detail the stage of last week's negotiations with the Spaniards or the Americans on the form of the contract. It does depend a great deal on the actual nature of the programme. With some of the programmes, which are much more diffuse, the communication is not so good.

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297. There is not a hole, and if there was a hole you would not wish to ask the Royal Society to fill it?

(*Dr Hughes*) I think that if there is a problem, it is a communication problem. We should point out that the Royal Society has assessors on our Council and on our Boards. As Sir Mark Richmond has said, the case of the large telescope, which I have an involvement in, has been aired very much, for example, in the Royal Astronomical Society which also has an assessor on our Astronomy and Planetary Science Board. If there is a problem it is possibly one of communication between individuals who have had a personal and direct involvement in some of these discussions, and others who are having to rely on those individuals, or other methods of communication, to be kept in touch with what is going on. I do not think it is a structural problem of there being an absence of an appropriate body or representatives on that body.

Lord Nelson of Stafford

298. A lot of witnesses have complained about the slowness of the machinery, how long it takes to get a decision and how we as a country are left following other international bodies rather than leading them because the machinery is so cumbersome. It does not seem to quite tie up with what SERC has said.

(*Sir Mark Richmond*) I think the problems lie in the areas where there are proposals for rather grand and different programmes—human mobility and things like that. You have a lot of a discussion about whether you should have a programme on human mobility, you then have a further set of sub-discussions as to what that means and where they will lie and questions of that kind. I think in that area the communication is not as good, I would absolutely agree with that.

Chairman

299. Do you feel that the Cabinet Office, the Chief Scientist's Office there who are supposed to co-ordinate the reactions where different government departments are involved, does function efficiently and meets that purpose to ensure that a co-ordinated government answer, with all the government departments concerned and all the research councils concerned, gets produced in a reasonable period of time?

(*Sir Mark Richmond*) You would have to take evidence, as I am sure you would, from the Chief Scientific Adviser. I only see his operations at a distance. He clearly, in my view, does an excellent job. He is encumbered by the fact that he does not have any money to spend. The money, of course, is in the spending department and, therefore, his role is one of cajolery. Nevertheless, he carries out an extremely helpful role in many cases.

300. In the preamble to your written evidence, when you said you believed that given stronger and

more active political leadership the UK could derive greater benefit from its investment in international scientific programmes, what did you actually have in mind?

(*Sir Mark Richmond*) That is a very political point, in my view: I did not write the document and was not in this job at the time it was written. I would interpret that as a comment on the different perceptions, or the way we see things operating, in this country and, for example, in France. There, there is a massive and extremely strong presidential push behind the the science programmes and the funding of science programmes. It makes an enormous difference to the way in which science is seen in the country and the way in which it is effectively prosecuted.

301. Would you like to see a minister for science?

(*Sir Mark Richmond*) I have thought about that a great deal. Being a bit of a pragmatist I always come down to looking at the problems that will be encountered in setting up such a post. The worries I would have would be that the post would have to be a Cabinet post to be most effective. The person concerned would have to have a budget, and I would always be a little bit concerned that, even with the considerable sums that are spent on science, the total clout of that minister in spending terms would be small compared with the big constituencies of education, health and things like that. Although I am attracted to the idea, in the sense that here is a person to speak for the country on scientific matters, I think at the end of the day it is a question of where does the clout lie? I am not convinced—and this is perhaps a pragmatic reply—that it would be easy to set up a structure and a process that would actually give the minister of science, even if there was one, sufficient weight.

Lord Flowers

302. Sir Mark is making an assumption which is not warranted, that the minister has to have a budget. I know Japan is very different but in Japan there is a council like ACOST and it is actually chaired by the Prime Minister; it produces a public annual report which is submitted to Parliament and the Prime Minister answers questions on it. The influence in Cabinet is the Prime Ministers's and not ad personam but ex officio. It seems to me that that sort of ministerial relationship between Cabinet and science is a good one. A minister with a small budget is not a good one.

(*Sir Mark Richmond*) Correct.

Lord Shackleton] We have a Prime Minister and she does not do that—she could.

Lord Flowers] But she does not.

Lord Kirkwood

303. I would like to ask whether Sir Mark would enlarge on his comment about the remoteness of the minister from the DTI representing the UK on the

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[Continued

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EC Research Council. He was saying he was rather remote from SERC. Did you not feel a Minister from the DES would be the more appropriate person to speak for United Kingdom research?

(*Sir Mark Richmond*) This is where I do not, at the moment, know enough about the mechanisms. On the Framework Programme overall the DTI is in the lead, so the overall programme is in the hands of the DTI Minister. Line 6, will have 50 percent of its funding in the hands of DES and I think the rule is, that on Line 6 matters a DES Minister will take the lead. That remains to be seen, but it is my understanding of how it will work. That will be a move in the right direction.

Lord Taylor of Blackburn

304. Could it not work under the same system as the ODA works under with the Foreign Office?

(*Sir Mark Richmond*) I do not know enough about that. Can you explain a little more?

305. Their budget in the main comes from the Foreign Office and they are a separate department to carry out overseas aid. They have their own autonomy with the budget coming from the Foreign Office but with direct links between ODA and the Foreign Office.

(*Sir Mark Richmond*) By that you imply the formation of a Department of Science and Technology? I would have to think about that.

Lord Dainton

306. I would like to put a question about mechanism to you since we are all concerned about it this afternoon. The obvious thing is, what in a sense used to happen to a considerable degree twenty odd years ago, which was that the Chief Scientist was in the Cabinet Office with a staff big international and all projects of various kinds came to him. Would you welcome an arrangement in which he was involved both in co-ordination of advice to Ministers at the point of going into Brussels and also probably in terms of attribution would you feel it was a more comfortable arrangement which would do the job better?

(*Sir Mark Richmond*) I think our relationships with the Scientific Adviser are good. What I do not know myself, because it tends to occur within the ring fence, if I can put it that way, is what role he actually plays. I think you would have to ask him.

307. He is in a central position, a point of all communications with all the departments on matters concerning science and very close to ACOST also therefore that the central area should be more fully used and prevent the kind of absurdities you mention—perhaps attribution done with a broader knowledge of what is going on elsewhere, or at the end of the day the representations which were made were made without adequate scientific advice.

(*Sir Mark Richmond*) Speaking personally, I would welcome an arrangement of that kind with increased output. What I do not want to see is another board established above ACOST and ABRC. Even with the well-meaning efforts of the Royal Society helping, as it were, I do not believe that that would guide all this forward.

Chairman

308. ABRC could not do it itself.

(*Sir Mark Richmond*) There is the whole ACOST side of the house and the very real input of the Department of Trade and Industry in its role in the funding, and help on science and technology in the country. So I do not think ABRC could do it itself.

309. Could we shift now to the bottom-up and the complaint (there are a very large number of complaints) that it is difficult for a group of scientists, having got together and found with colleagues overseas that they want to start an international programme, to discover how to set about it, how to get it funded, how to get the whole thing going, and that there are then enormous delays when they have thought they had found a way to do it. Surely your own organisation comes into this a great deal?

(*Sir Mark Richmond*) Absolutely. I think it is obvious to say that the problems increase rapidly in relation to the number of participants. So I think there are certain rules of thumb if you are a young research worker wanting to start international collaboration. I realise in certain areas this is not possible. You try and start it on a one-to-one basis and you try to do it within an area where one committee in the Research Council can make the decision. That is not always possible. I agree that, if you suddenly want to mount a project in space engineering which would involve the European Space Agency or something, you have a very big uphill struggle and part of the essential before you mount such a scientific programme—this is the tragedy of it—is that you have to know your way round the corridors of the European Space Agency to get people speaking on the other end on your behalf. It is a very, very hard job for people to get some of these projects going.

310. Have you a child's guide for this?

(*Sir Mark Richmond*) No, we have not. Our experience would be, I think, that each case is so different that it is extremely difficult, other than making some statements like those I have made already, to produce much of a guide as to how to go about it.

(*Dr Hughes*) I have nothing to add on that. I think it depends so much on the individual type of collaboration that is envisaged.

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311. So your answer to all the various complaints one has on this is the same as Mr Tebbit's answer—"Get on your bike, bicycle to Brussels or wherever it is"?

(*Sir Mark Richmond*) I have frequently heard it said by people in my ex-university that Brussels seems terrifying till you go there and start talking to the people, it then becomes much easier. So there is some element of getting on your bicycle and going there and getting yourself stuck in.

(*Dr Hughes*) In that particular case, Chairman, I think we should say that the Council does increasingly give a lot of support to academic researchers who wish to make inroads into Brussels. There is the Research Councils' Brussels Office, for example, which acts as a hub of communication in Brussels which all the Research Councils participate in and contribute to. There are also a variety of other meetings, formal and informal, and particular points of contact within various parts of SERC (and doubtless too the other Councils), where the process we hope is aided and improved. The Brussels office has four people now.

(*Sir Mark Richmond*) I am sure it will grow.

Baroness Nicol

312. On the same tack, Lord Chairman, what is your attitude towards giving individual grants to scientists who want to get on their bike and go to Brussels? What is the machinery for doing that? We understood from a number of universities that the money for this kind of exercise is simply not available.

(*Sir Mark Richmond*) I notice in one of the questions you sent us asked if we give grants for travel. The answer is, yes.

313. What starts it off? Do you wait for an application?

(*Sir Mark Richmond*) Yes.

Lord Shackleton

314. I was going to ask you something in relation to ESA. You do, in fact, have to deal a great deal with ESA because the astronomical side is not basically BNSC's job, as I understand it, and they have their own man on astronomy. How do you work? Do you go direct to ESA?

(*Sir Mark Richmond*) Yes. There is quite a lot of to-ing and fro-ing.

315. So you do know your way round ESA?

(*Sir Mark Richmond*) Yes.

316. Do you therefore participate in the decision-making by BNSC?

(*Sir Mark Richmond*) Yes, we are members and participants.

Lord Lewis of Newnham

317. My Lord Chairman, although I think Europe is a fascinating part of the world, I do genuinely believe many scientists are more interested in places like America which have certainly not been touched on in this discussion. I think it is important to recognise how we can build up collaboration with places in America. I was just wanting to ask, if I may, exactly how a young scientist would go about building up a research programme with someone, say, in America who is likely in my particular area to be more of interest than would someone from Europe.

(*Sir Mark Richmond*) A great deal would depend on the scale of the operation, as Lord Lewis will immediately recognise. I would have thought that, unless very large pieces of machinery were involved, or very expensive computer programmes or anything like that, it could be handled within SERC's normal grant allocation procedures. Now, I suppose the question that is really important is if you come to the point where someone wishes to construct a large piece of machinery which would be in America or in Britain, which would be used by Americans and British. It is at this point that things get much more complicated and SERC would have to start to act as an agent for that person.

The way I imagine it would go is that the proposal to do this would be put to SERC, SERC would make a decision in principle as to whether it was interesting science; if it was interesting science and within the budget I think we would then take on the job of trying to negotiate our way with the young person to a happy outcome. I think each case would have to be treated on its own merit.

318. I realise I cannot expect Sir Mark to have the figures in his head, but it would be very useful to know how many programmes have been of a joint nature between ourselves and, say, America (and I am quite happy to take Europe into the fold as well), because I would like to know what sort of interaction we actually have established on this basis?

(*Sir Mark Richmond*) We will look into that.

Chairman

319. I get the impression, not knowing about this, that everybody is so obsessed with the European Framework Programme and with the difficulties of dealing with the Framework Programme—and, after all, the Framework Programme only covers a very limited area of science anyway—that all the rest of the area, within Europe or not, tends to be forgotten about. As Lord Lewis raised, in the case of the United States, other international co-operation perhaps gets rather pushed aside by the Framework Programme. Is that the case, or is that just there are so many complaints about the Framework Programme, and there are not

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complaints about other international programmes, that it is absorbing too great a degree of effort at the expense of other international programmes?

(*Sir Mark Richmond*) I think it is only when what we call, very big science comes into play that these programmes develop. Basically people like to try and keep it simple. One has in space the European Space Agency; in nuclear research one has CERN, and the German laboratory in Hamburg—DESY; there is also a big research institute in Grenoble. These are basically where you are forced into an international collaboration because of the need to provide very expensive equipment. There are other reasons for establishing international programmes. My experience as a scientist is that I had many, many joint projects running with people in other countries, but they could all be encompassed within the normal grant application process.

320. *Action concerté*.

(*Sir Mark Richmond*) This is the European Commission coming into it, yes, that is right.

Lord Lewis of Newnham

321. It does seem to me that one of the big programmes in the international programme by the very nature of it tends to large amounts of money?

(*Sir Mark Richmond*) Yes.

322. If one takes the section which you very kindly wrote out for us in your introduction, I believe that it is the research grant section that tends to very often suffer. It tends to be the research grant section, which funds the majority of the chemistry community; I would think that would also be true in biology and, to a lesser extent possibly, in physics. I am slightly concerned when you have a limit to your budget that anything you do there must be basically at the expense of that first item, the research grants, on your list. This is a major concern. How far does this in any way restrict either directly or indirectly how you view international collaboration programmes?

(*Sir Mark Richmond*) I think it has to have a major effect. It is much influenced by whether one's opinion of the developing scene is basically expansionary or not. There is a case in point which came up in discussion in SERC last week, where there is a contract to provide the French with a certain amount of commitment on a facility which is in Britain. Various circumstances are leading to a need to cut back the use of that facility but we still have the commitment to give the French their time, and the British programme therefore suffers disproportionately.

Chairman

323. That brings me to ask your opinion about what the advantages and disadvantages are of hosting major projects in this country?

(*Sir Mark Richmond*) The projects we are talking about are basically where there is a requirement that they are located in one place and used by people internationally—a big machine. We in this country have not been as energetic as we might have been to attract such facilities to this country. I think the only one we have of any size is JET. The French, for example, driven very much from the top, see it as a matter of national prestige to have a number of these facilities and I think are not as assiduous, as perhaps we would be, in doing a hardnosed financial cost benefit analysis; or if they do it they begin to take into account questions like, how much money is brought into this centre and then deployed into the community by the people who actually work there; much more indirect additions to spend and matters of that kind. If I may say so, I think you have to reach a judgment which is much wider than the pounds, shillings and pence of the narrow issue of siting a particular piece of machinery in Berkshire for example. At the moment the pressures that are demanded of us are very much a short-term value for money with much more attention to the much greater ability to define what you mean by money than what you mean by value.

Lord Flowers

324. The facilities which are sited in France, am I right, are facilities which are provided for a wide range of scientific disciplines, like chemists who make great use of the institute at Grenoble and will make great use of the Synchrotron Radiation Facility?

(*Sir Mark Richmond*) Yes.

Lord Flowers] Perhaps that has to some extent tempered the attitude of the French in these things. We have tended to go for the very narrow subject areas for things we want to provide internationally, and that seems a pity.

Lord Shackleton

325. Do you see examples of misapplication of expenditure in France which you think has been really wasted?

(*Sir Mark Richmond*) No. I am saying that the French have a much more open-minded view, without knowing in great detail about how they do it. They seem to be prepared to take into account some of the peripheral nebulous advantages which cannot actually be turned directly into French francs.

Chairman

326. If you were responsible for more major international scientific installations in this country would that not aggravate what you complained about much earlier on, that a lot of your money would be tied up in major things? Would you like to have CERN in this country?

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[Continued]

[Chairman Contd]

(*Sir Mark Richmond*) I will give you a flip answer—I would like to have CERN if I was not paying too much for it and the other participants were.

327. You would then be in this situation surely, that there would be an inevitable amount of your budget that was fixed and you could not withdraw if it was in your own country. If the other people started to think they were going to pay a bit less for it you would be left with it on your hands?

(*Sir Mark Richmond*) I think in all these international projects, and it is case on case on case, you have to reach a judgment as to the value of doing it and of not doing it. The thing that is extremely difficult—and I have already said it in SERC—is that I find too little attempt to assess the opportunity costs of getting yourself in. Some of these opportunity costs only come home to roost a few years later when your funding shrinks and you discover you are locked into a position.

Lord Flowers

328. Big projects are important and do tend to dominate things. There is international collaboration on small scale science as well and research councils like Sir Mark's have been involved for a very long time. Could you tell us something about whether you find organisations like the European Science Foundation and now maybe the Academia Europaea useful as organisations through which you can help scientists, at any rate in Europe, to collaborate together on things that do not require large facilities?

(*Sir Mark Richmond*) To give you a rather odd answer to that: I think these institutions frequently have great benefit because they force meetings of people from which, outside the room, developments flow which might not otherwise take place.

Lord Lewis of Newnham

329. Sir Mark referred to the situation of NATO. NATO has provided a vehicle certainly for small scale initiation collaboration both on exchange between laboratories, running schools and running workshops where the interaction between scientists can be very fundamental.

He also referred to the fact that the contribution to NATO was no longer within his particular ambience, it had now been taken over. Would he like to comment on the desirability of that? Perhaps it is too early a day for it.

(*Sir Mark Richmond*) I am content enough, I think, about the NATO arrangements, Lord Lewis, because at the end of the day a great deal of the money actually flows back into the United Kingdom, and flows back into SERC, and we have a very, very big input into who then receives it. I am happy about that. I would just add another thing: there are other organisations that are very active in this area too, in the area that Lord Adrian will know about, the European Molecular Biology Organisation in fact funds a very, very large number of

exchanges and many private foundations act in similar ways. I am a trustee of the Ciba-Geigy Trust. We have specific programmes for sending people to Europe for specific purposes and an enormous amount goes on in which the Research Council play a part. As Lord Flowers said, it is when you come to consider the very big deployments of resource, or the need to put something in one place because it is very big, that these complicated issues arise.

Lord Adrian

330. To hark back to the Human Frontier Science Programme, you seem to be suggesting in paragraph 3 on page 4 that there are difficulties arising even in programmes which are in your terms relatively small.

(*Sir Mark Richmond*) Yes.

331. I think this is because, as I would understand it, the original negotiations, perhaps the original suppositions as to cost, have not turned out to be—

(*Sir Mark Richmond*) — the same.

332. The fact is, the sums are small, that is not a programme that is involving large apparatus, it is a programme essentially of responsive grants.

(*Sir Mark Richmond*) We come back in a way to the question of the distinction between programmes and facilities. There are such problems associated with the international facilities. I think the programmes are very, very much more likely to get bedevilled with the sort of political considerations and constraints of one kind and another; and on the cost benefit analysis I tend to think, although they are nice in concept, in practice they turn out to be pretty difficult.

333. Can I pursue that? You said earlier that the SERC was in fact involved in the original negotiations of this. Were the negotiations indefinite and unsatisfactorily clear?

(*Mr Merchant*) I think the difficulties over the HFSP were, as far as the SERC was concerned, primarily because the DES and the MRC were in the lead and we were quite rightly a secondary participant and, therefore, again it was slightly difficult for us to get what we felt to be our views fed in.

(*Sir Mark Richmond*) It sounds as though we always want to get our own way—it is not that. We have a natural inclination to do that, but we also want things to run effectively.

Lord Nelson of Stafford

334. Just a short question before we conclude: currency exchange fluctuations have not been mentioned. That you say in your submission to us remains the largest single difficulty for the Council. What is your idea?

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[Continued

[Lord Nelson of Stafford *Contd*]

(*Sir Mark Richmond*) I did not write that. Actually it is a very, very considerable problem, there is no doubt about that. I think our entry into the European exchange system will not help much in the short term because the bands are so wide, plus or minus 6 percent—there is still a colossal margin when there is 50 million in play. Anyway we are often shackled to the Swiss franc and it is not a European Community currency.

335. But we are at a disadvantage with our European partners who have themselves covered against that risk, whereas you do not?

(*Sir Mark Richmond*) That is right. The point is made that they are covered and that the tab is automatically picked up.

Baroness Nicol

336. You need Mr Major's hard ecu to solve your problems.

(*Sir Mark Richmond*) I take your word for it.

Lord Dainton

337. One question which worries me is this. I have had people represent to me in the area of small science that the position in this country is at the moment that there are a lot of alpha quality rated proposals which cannot be funded by the Research Councils but it is perfectly easy if you can find a European collaborator or plural collaborators from several countries to do even less good quality work,

the outcome of which is not properly monitored, by going to the Community. Is this a fact? Does it give you concern? Is there anything that can be done about it?

(*Sir Mark Richmond*) I really cannot comment. I have heard the same stories in my recently left university, as it were. I think they are sufficiently widespread that one has to take them seriously. I am actually quite struck and interested by the different approach that the European Community has to funding these programmes, in that they appoint a very senior and well-paid minder of the programme and this person actually acts in a very pro-active way to go out and seek work that this programme will then support. It is then his responsibility to go to, I guess, the Council of Ministers, or to his Commission and justify what he has done with the money that he has at his disposal in his programme. Of course, he uses assessors to help him reach a judgement.

338. He quite often overrides them, from my own experience as an assessor, which does not mean I am against it—quite the reverse, I am glad to see British scientists get the money, but I do think it is really unfair if there are people who fall between these two stools who want to do their work in this country and it is of higher quality.

(*Sir Mark Richmond*) Yes.

Chairman] Sir Mark, we are very grateful to you and your colleagues for an immensely interesting and valuable contribution to our understanding. I hope you will be able to get your own way.

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Memorandum by the Natural Environment Research Council (NERC)**EXECUTIVE SUMMARY**

Section A provides a general statement of NERC's policy on international scientific programmes (ISPs). Environmental issues are rarely national in terms of scale and structure and usually demand an international approach. NERC considers such international science to be beneficial and will continue to participate where appropriate according to its scientific strategies and priorities. This is to ensure that the UK environmental science community plays a full role in the formulation and execution of ISPs. NERC strongly believes in the scientist-to-scientist ("bottom") up approach in addition to more formal international relations. The only ISP to which NERC pays a formal subscription is the Ocean Drilling Programme (ODP). Most other international programmes are collaborative projects within programmes sponsored by organisations such as the International Council of Scientific Unions (ICSU) and the World Meteorological Organisation (WMO). These ISPs depend on the co-ordination of national programmes rather than the long-term commitment to shared facilities. NERC policy is to encourage participation in high quality international science programmes and to encourage collaboration between scientists at all levels.

Section B responds to issues raised by the Committee. It discusses the advantages and disadvantages of joining ISPs and outlines the problems experienced in raising the subscription for ODP. In discussing large facilities, reference is made to the exchange or research vessel time and to the increasing demands for international data networks in the environmental sciences. In both endeavours, NERC has a large role to play. The machinery for establishing ISPs and the decision-making fora are outlined. NERC has no difficulties with the Treasury guidelines on these matters. Difficulties of the problem of additionality with regard to EC programmes are explained. NERC does not see too many impediments in joining ISPs other than budgetary restrictions.

Annex 1 provides a guide to the complexity of international scientific relations in the environmental sciences and provides a list of NERC involvement in ISPs.

SECTION A: GENERAL STATEMENT

1. The environmental sciences span national boundaries. It is not surprising, therefore, that, traditionally, much of the research funded by NERC has been carried out within an international framework. This will continue to be the case for the foreseeable future.

2. There are a number of advantages from international co-operation. First, there is cost-sharing. Secondly, there is the ability to share facilities and obtain access to specialist facilities which may not be available otherwise. Thirdly, it creates access to data and encourages data exchange. Fourthly, it may provide the opportunity for access to remote field areas. Finally, there is the intellectual stimulation which stems from contacts with scientists from other countries.

3. Research on global issues is co-ordinated largely through the United Nations specialist agencies and the International Council of Scientific Unions (ICSU) which take the lead in formulating programmes aimed at such topics as climate and the processes that lead to global change. The development of these programmes involves wide consultation. The UK community makes a significant intellectual contribution to the planning process, even to those programmes where it may not be a major participant. NERC considers such international science to be beneficial and will continue to participate in the planning and execution of international science programmes (ISPs) such as the World Climate Research Programme (WCRP) and the International Geosphere-Biosphere Programme (IGBP). Our involvement in ISPs is guided by our overall science strategies and priorities and we participate only when we see a clear role for the UK to play and where we can build on UK strengths.

4. The Antarctic represents a special case in terms of ISPs. Through the operation of the Antarctic Treaty System and the ICSU Scientific Committee on Antarctic Research (SCAR), there is a framework for international collaboration which is valuable. ISPs and international collaboration are the usual way to develop science programmes in the Antarctic region and this has been of considerable benefit in the development of the science.

5. Research on regional issues such as acid precipitation, pollution and land use will be increasingly driven by European Commission (EC) standards and legislation. EC policy is to encourage greater co-operation in such research between institutions in the different member states. The EC is expanding considerably its support for environmental research and for environmental survey and monitoring. This is achieved by means of contractual research programmes in which multilateral collaborative research projects are encouraged in order to strengthen the EC's research and development infrastructure (cohesion). NERC has been an important contractor to the EC for a number of years and a close working relationship has been established with EC programme managers. NERC plans to strengthen these links and those between the UK institutions and equivalent organisations in other EC member states.

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6. Also within Europe, but extending into the European Free Trade Association (EFTA) nations and beyond, the European Science Foundation (ESF) initiates international science programmes as well as encouraging the scientists themselves to move around the European science community. The ESF offers considerable scope for scientists to participate in setting its research programme and to create working links between scientists in different European countries.

7. Scientific knowledge expands through the interchange of new ideas and approaches between scientists worldwide. This “international brainstorming” is the fundamental and strongest element in international science. Success in international scientific collaboration depends on this scientist-to-scientist (“bottom-up”) approach, which NERC aims to foster by organising and hosting international seminars and workshops.

8. NERC’s formal international scientific links fall into a number of categories, viz:

- (a) membership of major international scientific programmes (ISPs) and facilities. We are only involved in one major high cost ISP. This is the American-led Ocean Drilling Program (ODP) in which NERC is one of seven full members;
- (b) programmes organised by inter-governmental organisations (IGOs) such as United Nations agencies; European Space Agency (ESA); North Atlantic Treaty Organisation (NATO) and the Antarctic Treaty System (ATS);
- (c) programmes organised by non-government organisations (NGOs), especially those run by the International Council of Scientific Unions (ICSU) and the European Science Foundation (ESF);
- (d) European Commission (EC) programmes;
- (e) formal bilateral arrangements (Memoranda of Understanding—MOUs);
- (f) overseas commissioned contracts.

Some of the international science programmes may straddle several of these categories. This is especially so in relation to climate change and global environmental research programmes. Annex 1 provides a list of current ISPs with which NERC is associated excluding categories (e) and (f), which are not considered to fall within the Select Committee’s main area of interest.

9. It is NERC’s policy to continue to encourage participation in high quality international science programmes and collaboration between scientists at all levels. It is developing its own strategy to stimulate such participation and to foster international research in the environmental sciences.

SECTION B: RESPONSES TO ISSUES RAISED BY THE SELECT COMMITTEE

(i) Advantages and Disadvantages in Joining ISPs

1. Reference to ISPs usually envisages an arrangement covering support for a major facility, such as CERN, where there is a long-term financial commitment and the facility provides the support for the scientific activities of several nations and for many scientific programmes. The only ISP supported by NERC to which this definition may apply is the Ocean Drilling Program (ODP). This differs from the CERN model in that, while having a long-term financial commitment and the provision of a facility, the drillship “JOIDES Resolution” and central support at two US academic institutions, ODP is very much a science-led rather than a facility-led ISP. The rest of the major ISPs with which NERC is concerned are collaborative programmes in which there is co-ordination between self-sustaining national programmes. Advantages and disadvantages of such ISPs, which are the norm in the environmental sciences, differ from those of the “facilities” ISPs.

2. The UK has a strong international reputation in environmental research which is reinforced by participation in ISPs. ISPs allow nations to pool intellectual and financial resources (e.g., research vessels) in pursuit of scientific goals which would be too ambitious for any one nation to tackle alone. They also allow scientific progress to be made much more quickly than would be possible through a smaller effort. This is especially true for programmes on global-scale processes. The total output from ISPs usually adds up to more than the sum of the parts; this produces an added value from participation (access to more data, development of productive collaborative links, technology transfer, etc). In this respect it could be argued that funding departments get better value for their investment if their national programmes are associated with appropriate international programmes.

3. Research in many aspects of the environmental sciences has to take an international approach. We need access to areas where particular phenomena occur or some means of obtaining observations about such events. Often a comprehensive study will require either simultaneous observation on a worldwide scale or the ability to mount major observational experiments. These are often beyond the ability of a single nation to support. Constraints may be financial, in terms of facilities and manpower and may be beyond the intellectual resources of a single nation, especially if the research community is small and specialised. In addition, the need to have reciprocal arrangements is often a prerequisite for data exchange between national programmes.

4. Sound management and good co-ordination/communications between national efforts is vital to the success of ISPs. Without it, additional costs are likely to be incurred. Problems may occur in ISPs if

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individual national efforts are dependent on each other for progress to be made, i.e., progress in the ISP is dependent on the rate of progress in the slowest/weakest national contribution. To overcome this, the approach that has been taken by NERC to British contributions to major ISPs such as the Joint Global Ocean Flux Study and World Ocean Circulation Experiment, is that they should have a scientific integrity in their own right and be designed to tackle the problems of highest strategic importance to the UK.

5. One of the disadvantages of an ISP to NERC is that there is often a time-limited "window of opportunity" for participation. This can create problems of timing in relation to the development of national programmes and their related resource allocations. The disadvantages experienced with ISPs are in the difficulties of maintaining continuity of national participation with its appropriate resources.

6. ODP is different from the other environmental ISPs as it is based on a financial subscription to support a central shared facility and infrastructure. To capitalise on the investment, and the opportunity which it provides, earmarked funds need to be provided to support those UK scientists taking part in ODP. In the case of the UK's (NERC's) participation in ODP, the subscription commenced at \$2.5m pa (now risen to \$2.75m) to which Council has added a Special Topic Research Grants scheme of £300k pa and a further £100k pa to support UK scientists' participation as members of shipboard scientific groups and attendance at science planning meetings. This additional £400k represents about 25 per cent of the subscription value, all of which has to be earmarked for the duration of the programme.

Overall, the advantages and disadvantages of participation in ISPs can be summarised as follows:

- (i) the UK benefits from:
 - (a) the scientific exchange because science is by its very nature international;
 - (b) the benefits that flow from the UK's best young people meeting and working with their counterparts in other nations;
 - (c) an international network which can aid UK foreign policy objectives;
 - (d) sharing of the costs of research and economies of scale;
 - (e) the added value that comes from research collaboration;
 - (f) technology transfer out of and into the UK;
- (ii) the UK may be disadvantaged by:
 - (a) lack of freedom for independent action;
 - (b) escalation of costs through international management or decision taking where consensus has to be achieved, or through currency fluctuations;
 - (c) differences in planning cycles and fiscal years causing difficulties with finding resources.

(ii) *Advantages and Disadvantages of Hosting Large Facilities*

1. NERC does not host any large ISP facilities. Indeed there are few such facilities in the environmental field. The ODP drillship, JOIDES Resolution, is a notable exception.

2. The sharing of national facilities is, however, another aspect of productive international collaboration in the environmental sciences. In particular, research vessels are expensive to run and the international research fleet is relatively small. Scientific instruments fitted to research vessels are becoming so costly that no one country can afford to provide all the facilities demanded by today's marine scientists. It is worthwhile exchanging information about ship-programming in order to exchange ship-time or participate in a scientific cruise run by another nation. NERC, together with the US National Science Foundation, developed a machinery for achieving this sharing of ship-time and this is now expanding to include the research vessels of other nations with strong oceanographic research programmes. This is the International Research Ship Operators Consortium, an informal annual meeting, which has enabled successful exchanges of ship-time and major facilities. The European Research Ship Operators Group, to which NERC belongs, was established by the EC and is an agency for effecting introductions between users and operators on a European basis as well as being a forum for exchange of views on problems of mutual interest. The most successful collaboration in Europe has been between NERC and the Institut Francais de Recherche pour l'Exploration de la Mer (IFREMER), who are represented on both groups.

3. Although not a "large facility", *sensu stricto*, NERC does host the International Planning Office for WOCE (at the Institute of Oceanographic Sciences, Deacon Laboratory—IOSDL); plays a leading role in the international planning of JGOFS and may do the same for other IGBP core projects. NERC's view is that it is critically important to be involved, at the earliest opportunity, in the international planning of projects in which we wish to be involved. This ensures that the projects are developed in a rational way and that UK national priorities are strongly reflected in the international programmes. In terms of EC programmes, there are similar advantages in being the principal contractor with responsibility for co-ordination/management of the multi-national research effort and in developing links directly with EC programme officers.

4. The storage and manipulation of data is an increasingly important area for the environmental sciences. The increasing emphasis on global programmes requires access to data on a world-wide basis.

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Rather than developing major international data centres, the trend is to network national centres. NERC has a number of major data banks which allow for a "trade" in data and the encouragement of collaboration which might not otherwise occur. Particular examples are the British Oceanographic Data Centre (BODC) at the Proudman Oceanographic Laboratory (POL) and the Environmental Information Centre (EIC) at the Institute of Terrestrial Ecology (ITE). Not only do these centres form parts of international data networks and the focal points for access to other data banks but they provide active support to scientists in the processing and quality control of data as well as undertaking innovative work on the development of data products. For instance, POL makes a significant contribution to the Permanent Service for Mean Sea Level (PSMSL) and the Global Sea Level Observing System (GLOSS), a high quality global network of primary tide gauges. Both are co-ordinated and part-funded by the Inter-Governmental Oceanographic Commission (IOC) and are hosted at the Proudman Oceanographic Laboratory. The data bases provide support to marine ISPs such as WOCE and JGOFS. The EIC brings together ecological databases with the Biological Records Centre and provides the management of spatial data. EIC has a considerable involvement with the EC CORINE (Coordinated Information on the European Environment) programme in which the EIC coordinates information on sites of importance for conservation across the entire community.

5. One highly focused international data centre that has been developed and which is hosted and managed by NERC is the BIOMASS Data Centre at the British Antarctic Survey. The programme on Biological Investigations of Marine Atlantic Systems and Stocks (BIOMASS) is an ICSU programme promoted by its Scientific Committees on Antarctic Research (SCAR) and Oceanic Research (SCOR). BIOMASS involved extensive international biological investigations in the Southern Ocean with data being lodged with BAS. By hosting this facility, UK scientists have had a major influence on the development of the programme and have had easy access to data from a variety of sciences. The centre has been a focus for workshops bringing together scientists from all the nations involved in the programme. This has materially assisted UK scientists in maintaining a strong position in the forefront of the marine biological field.

6. Environmental ISPs rely heavily on computing and on remote sensing, especially space-based remote sensing. Computing is a national activity. However, remote sensing from space benefits from being organised and managed on an international basis, and the UK programme is committed to working through the European Space Agency (ESA). Earth observation satellite missions need to be closely integrated with surface observations in order to address specific environmental problems. Along with colleagues from other countries, the UK environmental science community must be able to influence the planning of missions and satellite instruments development. Also, space missions must be synchronised with ISPs so that remotely sensed data can be integrated with ground observations. A good example of this is WOCE which will utilise the ESA ERS-1 and ERS-2 satellites as part of its long-term observational programme.

(iii) (iv) and (v) Machinery for Establishing ISPs; Technical and Financial Criteria; and Fora for Decision-making

1. The establishment of international programmes can occur through a variety of routes and processes involving both policy driven initiatives (the so-called "top-down" approach) and scientist-to-scientist ("bottom-up") links. The former can involve international action at a number of levels within IGOs and NGOs at which the UK, although not necessarily NERC, is represented. IGOs tend to represent most of the top-down initiatives such as those emanating from the EC, the Council of Europe, IOC or similar bodies.

2. Bottom-up scientific initiatives usually involve the identification of common scientific priorities by scientists in leading nations which are then adopted by an IGO or a NGO as a proto-international scientific programme. In many cases, the initiation of an ISP may result from the direct sponsorship of scientists through workshops or networks as often happens within the European Science Foundation or through the Committee for European Co-Operation in Science and Technology (COST). Within the UK, the Royal Society and other learned societies play an important role in fostering and encouraging the community's response to such international initiatives.

3. International scientific steering groups are usually established to plan major programmes often with sponsorship from NGOs/IGOs. Scientific planning may take time and major programmes can be several years in development. This is because of the need to arrange the conjunction of facilities programmes, such as satellite instrument development, and "ground" observational programmes. Such timescales are not inappropriate when dealing with observational programmes lasting several years to a decade, as in the case with WOCE.

4. Decisions as to participation in ISPs take place in a variety of fora and at a variety of levels. There are a range of decisions from agreement, in principle, to participate on scientific or policy grounds to decisions to commit resources at a certain level. The Royal Society is directly involved in developing decisions on the scientific validity of the major science programmes but it is the funding agencies which have to decide on the resources which can be made available. In particular, the final decision to participate in an ISP can only be confirmed if resources have been won through the competitive Research Council machinery.

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This ensures that the priority of international participation is weighed against national programmes and the possible "added value" of international participation is assessed. Consultation with funding agencies at an early stage in planning can assist both funding agencies and the planning group. Within NERC, decisions are taken through the appropriate levels of Council decision-making, especially the Science Committees and at Council itself, judging participation in ISPs against other scientific priorities.

5. The standard criteria apply in assessing participation in ISPs, namely: scientific/technical excellence; priority and timeliness; applicability; exploitability; and, affordability. In addition, the need for a multi-national co-ordinated approach must be justified. In the case of ODP, which demands a longer-term partnership between the members, NERC has to be satisfied not only that the programme is of high scientific priority but that a long-term financial commitment can be made together with provision for the supporting scientific infrastructure. The NERC approach has been to be highly selective on which ISPs to join, but to try to make a substantial contribution to those which are considered to be the most timely and of highest priority to the UK.

6. Involvement in ISPs may be possible at a number of levels. In some instances the most appropriate level in terms of the scientific contribution which we could make may be in excess of the resources available and additional funding may need to be sought through bids to the Advisory Board for Research Councils (ABRC). This latter body, directly or indirectly, can have a major influence on the size and type of the UK contribution to ISPs.

(vi) Government Practice and Guidelines on ISPs

1. Following a review of international scientific programmes in 1988 and 1989, the Government introduced guidelines to determine the case for UK participation in major international scientific collaborations. These guidelines set out formally, for the first time, a series of commonsense points which should be addressed in making decisions on participation in ISPs. NERC welcomes these guidelines, and supports them in principle and in practice. However, guidelines must be seen as that. They are no more and no less than a framework in which to operate; each case needs to be looked at.

2. The underlying basis to these guidelines is that the objectives of an ISP must have the support of and/or have been developed by the scientific community. In other words, the scientific excellence and priority of the programme must have been established before embarking on the detailed analysis and negotiations of the level of participation. This has to be based on the inherent worth of the programme and must not be judged against the standard of the lowest common denominator or weakest participant in the ISP.

(vii) Treasury Rules of Additionality and Attribution

1. The rules of additionality and attribution are relevant only to EC programmes in which NERC and other agencies are bidding for funding as research contractors. Other ISPs are normally funded from within existing Science Budget allocations or through bids for extra resources.

2. The Government seeks to control the UK public expenditure consequences of European Communities activities through departmental budgets ("attribution"). This is designed to have two practical purposes:

- (a) during the negotiations at the start of each Framework Programme, Departments have a financial interest in keeping the programme relevant to their own requirements and as cost-effective as possible; and
- (b) after the programme is agreed, Departments have a financial interest in securing as high a proportion of available funds as possible.

3. Provided that the present system for Research Councils continues to apply in the retention of funds won from the EC, then NERC would not anticipate any difficulties. Any major reduction in the Science Budget could have an impact on NERC's future science planning.

4. The EC policy of additionality follows on from subsidiarity, which constrains EC activities to projects additional to national programmes and provides a European added value. According to this EC policy, programmes for which EC funds are sought should not be considered as part of the national programme and should not be undertaken outside the EC context. Therefore there may be a potential conflict between the need to seek funding to offset attribution and the additionality concept which requires that funds are only sought over and above the national programmes. These two issues could combine to have a major impact on research priorities as the maximum funding obtainable by research institutes is 50 per cent of the total cost. It follows that the balancing resources would have to come from domestic funding so directing funds from possibly high priority domestic programmes to possibly lower priority (in our eyes) EC programmes. Failure to win funds would mean, theoretically, that the related 50 per cent domestic programme should not proceed.

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(viii) Impediments within the UK to joining ISPs

1. The key question in determining whether NERC should join in an ISP is its relevance to the environmental sciences and Council's own programme. The decision to join must be fundamentally one of the scientific merit of the proposal and whether the ISP can provide the added value, through international collaboration, which will enhance our research. The Government guidelines referred to above (section B-vi) provide a useful framework for decision-making.

2. Problems have arisen in the past in securing the necessary finance for participation in ODP. This arose historically during the 1970s from the division of the UK subscription for the Deep Sea Drilling Project (DSDP), the predecessor of ODP, between the Science Budget (NERC and earmarked DES funds) and the Departments of Energy and Industry. The mandates of the Departments constrained the use of their research funds to applied objectives of relevance to the Departments. At the same time, the NERC contribution required to be justified in terms of the basic scientific quality of the programme. The programme had to be presented as both an applied and a basic endeavour. Having established the applied relevance of the predecessor programme, NERC was then asked to seek funds from the private sector when ODP was established in 1985. This created considerable difficulties in raising the funds for membership with the result that the UK was only able to join the programme 12 months after its commencement with membership from France, Germany, Canada and Japan already agreed at the start of the programme. Currently the subscription to ODP (now at \$2.75m pa) is paid principally from within the NERC budget (with additional contributions from BP/Britoil and Enterprise Oil).

3. Although currency fluctuations can be a potential concern to programmes such as ODP, which involve a subscription payment, in fact, the size of the ODP subscription in relation to NERC's overall budget (1 per cent of the budget) is such that any problems in financial planning can be accommodated. Other overseas programme subscriptions met by NERC are relatively small and currency variations are not significant. The matter of currency fluctuations does not apply to the majority of our participation in international programmes where the involvement is through extension of strong national programmes into an international framework.

4. Insofar as ODP is concerned, we have not experienced any problems with regard to commercial and intellectual property rights. The governing Memorandum of Understanding gives all members of the programme equal ownership rights in these matters.

5. Hitherto, our international relations have not involved the USSR or Eastern Europe to any great extent. However, the changed situation and the opening of these areas to scientific collaboration requires a re-appraisal of our attitudes. COCOM restrictions, in particular, have tended to deter our research community from developing joint programmes as scientists see no point in working in countries to which they cannot take their equipment.

6. There is no restriction from NERC on overseas travel, provided that it can be justified in terms of the programme. NERC encourages its scientists to avail themselves of low cost travel offers and to use British carriers but does not impose any restrictions on travel arrangements.

(ix) Impediments in Other Countries to their Engaging in ISPs

1. We are not able to comment in any detail in the situation in other countries but in North America and Western Europe there is no impediment and every encouragement for participation in international science. In the USA, in particular, ensuring that there is an international aspect in any programme is often a pre-requisite in obtaining funding. Similarly, France and Germany frequently open up national initiatives to international participation as this can be an effective means of convincing funding agencies to support the project. In the latter case, both nations tend to work through European mechanisms, especially the European Science Foundation.

2. Our experience in Eastern Europe has been that it is difficult for researcher to obtain hard currency to visit western institutions and their weak infrastructure (including the frequent lack of basic communication facilities) can inhibit exchanges.

3. Commercial protectionism has not had any detrimental effect on the ISPs with which NERC is concerned as these are national programmes which contribute to a common aim. ODP is somewhat different and there was a problem with the "Buy American" rule in the Deep Sea Drilling Project, the forerunner to ODP. This has been overcome in ODP as tenders to supply materials and equipment are issued within all the member nations. Furthermore, the ship is not registered in the US and is not subject to the usual commercial restrictions applying to US vessels.

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[Continued

ANNEX 1

NERC INVOLVEMENT IN INTERNATIONAL SCIENTIFIC PROGRAMMES (ISPs)

(This list does not include the involvement of the Higher Education Institutions (HEIs) supported by NERC whose individual international links are very extensive.)

Complexity of International Scientific Relations

1. As with any multifarious activity, international scientific links in the environmental sciences are complex. This results from initiatives taken by IGOs, NGOs, bilateral agreements and scientist-to-scientist contact. Although this creates some overlap, it ensures that collaborative research is encouraged and does not fall in the gaps in the organisational structure.

2. The area of global environmental research may appear to be particularly complex. As the diagram (Figure 1) demonstrates the various international activities can be grouped into two major initiatives, the World Climate Research Programme and the International Geosphere-Biosphere Programme. It also shows the way in which projects can develop with the involvement of "top-down" IGO sponsorship through UN agencies and "bottom-up" initiatives arising from the scientific community through the International Council of Scientific Unions.

3. The European scene has its own complexities. The EC is a major promoter of collaborative research through its Framework Programme. Funding can also be obtained for research through the EUREKA programme, which concentrates on near-market research. In both cases, the European collaboration develops through the research contractor system. The European Science Foundation provides a different approach by encouraging the direct involvement of scientists in collaborative programmes. It encourages such contact through "networks" of interested scientists which often leads to the creation of research programmes for which support is sought from funding institutions such as NERC. NERC endorses this approach but it must be emphasised that participation in any ESF programme must convince the Council's Science Committees of its scientific merit. The existence of the various European groupings, to which must be added the European Space Agency, Council of Europe activities and the Committee for European Co-operation in Science and Technology (COST) initiatives, adds to the complexity of international science in Europe.

4. Although there is a complex web of international scientific relations, it is important to recognise that these links work and encourage collaboration and interchange. Without such structures, international scientific collaboration would be difficult.

SECTION A: SUBSCRIPTIONS TO MAJOR INTERNATIONAL PROGRAMMES/FACILITIES

Ocean Drilling Program (ODP): (Non-Governmental)	Subscription \$2.75m pa. UK is one of six members plus the USA subscribing to an annual budget of \$35m. NERC provides an additional £100k pa for participation in science planning and shipboard participation. £300k pa for Special Topic research grants in support of ODP. The earth sciences community (institutes and HEIs) benefit from this arrangement.
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SECTION B: PROGRAMMES ORGANISED BY INTER-GOVERNMENTAL ORGANISATIONS (IGOs)

*UN Specialised Agencies:**Inter-Governmental Oceanographic Commission (IOC):*

Permanent Service for Mean Sea Level (PSMSL): Global Sea Level Observing System (GLOSS):	Both run from the Proudman Oceanographic Laboratory (POL) with part-funding from the IOC as an international service
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Responsible National Oceanographic Data Centre (RNODC) for Wave Data:	This is contained within the British Oceanographic Data Centre at POL.
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[Continued

UNESCO

The UK is not a member of UNESCO but retains informal links through scientific programmes.

Man and the
Biosphere Programme
(MAB):

NERC provides the secretariat to the UK-MAB Committee which encourages the UK community to "shadow" MAB activities.

International
Hydrology Programme
(IHP):

The Institute of Hydrology (IH) has a project which is central to the IHP.

UN International
Decade for National
Disaster Reduction
(IDNDR):

Institute of Hydrology

UN World Meteorological Organisation (WMO)

World Climate Research Programme: (see Section C)

Tropical Oceans Global Atmosphere Programme (TOGA)

World Weather Watch
(WWW):

British Antarctic Survey

Antarctic Treaty System (see under SCAR):

European Space
Agency (ES):
(with the US National
Aeronautics and Space
Administration—
NASA)

British Antarctic Survey

International Solar
Terrestrial Physics
Programme (ISTP)

British Antarctic Survey

Global Geospace
Science (GCS)

British Antarctic Survey

CLUSTER

British Antarctic Survey

Polar Platform

British Antarctic Survey

Earthnet
ERS 1 and 2
Programmes

Links through BNSC and also principal investigators for ESA
British Antarctic Survey

SECTION C: PROGRAMMES ORGANISED BY NON-GOVERNMENTAL ORGANISATIONS (NGOs)

International Council of Scientific Unions (ICSU)(i) **Scientific Committee on Antarctic Research (SCAR)**

Biological Investigations of Terrestrial Antarctic Systems (BIOTAS)

British Antarctic Survey

Biological Investigations of Marine Antarctic System and Stocks (BIOMASS)

British Antarctic Survey

Antarctic Coastal Transects: British Antarctic Survey

Antalith: British Antarctic Survey

Filchner—Ronne Ice Shelf Programme (FRISP): British Antarctic Survey

(ii) **World Climate Research Programme (joint with WMO)**

Global Energy Water Experiment (GEWEX)

Hydrological Atmospheric Pilot Experiment (HAPEX): Institute of Hydrology

Sahel Energy Balance Experiment (SEBEX): Institute of Hydrology
First International Satellite Land-Surface Climatology Project (FIFE): Institute of Hydrology
World Ocean Circulation Experiment (WOCE): NERC Marine Sciences Directorate
Community Research Project (UK-WOCE)

- (iii) International Geosphere-Biosphere Programme (IGBP)
Joint Global Ocean Flux Study (JGOFS): NERC Marine Sciences Directorate Community Research Project—Biogeochemical Ocean Flux Study (BOFS)
Biospheric Aspects of the Hydrological Cycle (BAHC): Institute of Hydrology
Past Global Change (PAGES): NERC-supported universities and polytechnics
- (iv) European Science Foundation
Polar North Atlantic Margin (PONAM): NERC-supported universities and polytechnics
Greenland Ice-Core Project (GRIP): British Antarctic Survey
European Geotraverse (EGT): NERC-supported universities and polytechnics with central subscription from NERC Earth Sciences Directorate
European Palaeoclimate Programme: NERC-supported universities and polytechnics
European “Polarstern” Oceanographic Study (EPOS): British Antarctic Survey and NERC-supported universities and polytechnics
- (v) Arctic Ocean Sciences Board
These are “no-exchange of fuels” projects involving co-ordinated national programmes.
Greenland Sea Project: Scott Polar Research Institute, Cambridge University with support from NERC
International Arctic Polynya Project: Sea Mammals Research Unit
- (vi) International Seismological Projects
Observations and Research Facilities for European Seismology (ORFES) Subscriptions paid by NERC Earth Sciences Directorate
European/Mediterranean Seismological Centre
International Seismological Centre

SECTION D—INTER-FUNDING AGENCIES PROGRAMMES

Australia/New Zealand/UK Programme £24k provided by NERC on behalf of
on Global Climate Change (ANZUK/GC): UK research councils

International Research Ship Operators Consortium NERC membership through
European Research Ship Operators Group NERC Research Vessel Services

SECTION E: PROGRAMMES ORGANISED BY THE EUROPEAN COMMISSION (EC)

The NERC participation in these programmes is a contractor to the EC and the following list provides details of current EC contracts with NERC.

TITLE	START/ END DATE	VALUE	INSTITUTE	PROGRAMME
Hydrothermal Fluid Anomalies: A New Strategy for Geochemical Exploration	10-87 1-91	180,000 ecu	BGS	Raw Materials
Transfrontier Research in Low- Seismicity Areas	9-87 8-90	572,100 ecu	BGS	Environment
Physiological and Biochemical Approaches to the Assessment of Pollution of European Estuarine and Coastal Ecosystems	1-88 12-91	90,000 ecu	PML	Environment
Environmental Structure and Tropical Conditions in Relation to the Survival and Recruitment of Pelogical Fish Larvae	12-87 11-90	31,050 ecu	PML	Stimulation

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[Continued

TITLE	START/ END DATE	VALUE	INSTITUTE	PROGRAMME
Early Diagnosis of Forest Decline Associated with Atmospheric Pollutants	7-87 6-91	173,800 ecu	ITEN	Environment
Studies of the Effects of Pollutant Gases and Acid Mist on Young Trees in Open Top Chambers and an Investigation of Chamber Properties	9-87 8-91	142,300 ecu	ITEN	Environment
Liming and Fauna Innoculation to Ameliorate Acidification due to Air Pollutants	4-88 12-91	62,630 ecu	ITEN	Environment
Mechanisms of Nutrient Turnover in the Soil Compartment of Forests	11-88 11-91	500,000 ecu	ITEN	Environment
Complexation of Radionuclides with Naturally Occurring Compounds in Groundwater	12-88 12-90	214,000 ecu		Management and Storage of Radioactive Waste
Monitored Environment Release of Genomically Tagged Phylloplane and Rhizosphere Bacteria	1-89 1-91	122,100 ecu	IVEM	Biotechnology
Risk Assessment of the Field Use of Genetically Engineered Baculovirus and Plants	1-89 1-91	70,000 ecu	IVEM	Biotechnology
ESPRIT Project: 2316 Multisensor Image Processor (MUSIP)— Co-ordinated by Marconi Space Systems	1-89 1-91	106,000 ecu	NSS	ESPRIT
The Modelling and Dynamics of the Quaternary Geology of the Southern North Sea and their Application to Environmental Protection and Industrial Development	4-89 4-91	1,457,760 ecu	BGS	Stimulation
Measurements of Dry Deposition Fluxes of NOXI, PAN and HNO3 over Several Soil Types	6-89 6-91	297,000 ecu	ITEN	Environment
Application of Weather Radar to the Alleviation of Climatic Hazards	9-87 10-91	99,600 ecu	IH	Environment
Preparation of River Sediment Containing Permethrin and a Stability Study	7-89 12-90	£12,000	IFE	
The Use of Selective Viral Pesticides Against 5 Key Pest Genera on Nicaraguan Food Crops	11-89 5-92	192,000 ecu	IVEM	

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[Continued

TITLE	START/ END DATE	VALUE	INSTITUTE	PROGRAMME
Preparation and Reconstitution— Homogeneity—and Stability Studies of Lyophilised Permethrin and Simazine Containing Water Samples	7-89 12-90	£8,100	IFE	
Radioecology of Seminatural Ecosystems	4-90 3-92	50,000 ecu	ITEN	
The Fate of N-Compounds around the North Sea	2-90 2-92	32,500 ecu	ITEN	
Interpretation of Stratosphere Monitoring by Ground-Based Ultraviolet and Visible Spectrometers	7-90 7-92	53,480 ecu	BAS	STEP
Conduct a Study on Characterisation of the Dynamics of Desertification on the Fringes of the Sahel using Remote Sensing	7-90 12-90	49,250 ecu	ITES	
<i>Pending Signature</i>				
The Interaction between Fish Farm Induced Environmental Change and Fish Health in Intensive Mariculture	12-89 12-93	214,830 ecu	DML	
Factors Affecting Radiocaesium Transfer to Ruminants	4-90 4-92	200,000 ecu	ITEN	Radiation Protection Programme
The Control of Phytoplankton Dominance	5-90 1-91	87,450 ecu	DML	
European Directory of Marine Environmental Data (EDMED)	8 months from signature	29,500 ecu	POL	MAST
Modelling the Transport of Radionuclides Through the Freshwater Environment	5-90 5-92	100,000 ecu	IFE	Radiation Protection Programme
Corine Biotopes Project: Development of the Corine Biotopes Inventory	10 months from signature	133,000 ecu	ITES	Environment and Radiation Protection
Natural Variability and the Prediction of Change in Marine Benthic Ecosystems	19 months from signature	182,400 ecu	IOSDL	MAST
Statistical: Study on Raw Materials	6 months from signature	23,000 ecu	BGS	Materials
Biogeochemical Carbon Cycling in Coastal Zones	5-90 5-93	119,000 ecu	PML	MAST
Biogeochemical Fluxes in the Ocean-Sediment Environment	36 months from signature	565,000 ecu	IOSDL	MAST

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[Continued

TITLE	START/ END DATE	VALUE	INSTITUTE	PROGRAMME
European Regional Seas Ecosystem Model	7-90 2-93	180,300 ecu	PML	MAST
Mixing Processes at the Sea Surface	7-90 2-93	44,500 ecu	IOSDL	MAST
Major Biological Processes in European Tidal Estuaries	31 months from signature	83,220 ecu	PML	MAST

Participation in EC programmes is increasing through projects such as MAST, STEP and EPOCH of the Second Framework Programme. This trend will continue through the new Framework Programme (1990-94). In the current Framework Programme, it is likely that the UK will do well (for MAST, at least, the UK share of the funding should be above the level of *juste retour*). Of course, only 50 per cent funding is obtained from the EC, the rest coming through national contributions.

Key: NERC Institutes

BAS	—	British Antarctic Survey
BGS	—	British Geological Survey
DML	—	Dunstaffnage Marine Laboratory
IFE	—	Institute of Freshwater Ecology
IH	—	Institute of Hydrology
IOSDL	—	Institute of Oceanographic Sciences Deacon Laboratory
ITEN	—	Institute of Terrestrial Ecology (North)
ITES	—	Institute of Terrestrial Ecology (South)
IVEM	—	Institute of Virology and Environmental Microbiology
NSS	—	NERC Scientific Services
PML	—	Plymouth Marine Laboratory
POL	—	Proudman Oceanographic Laboratory

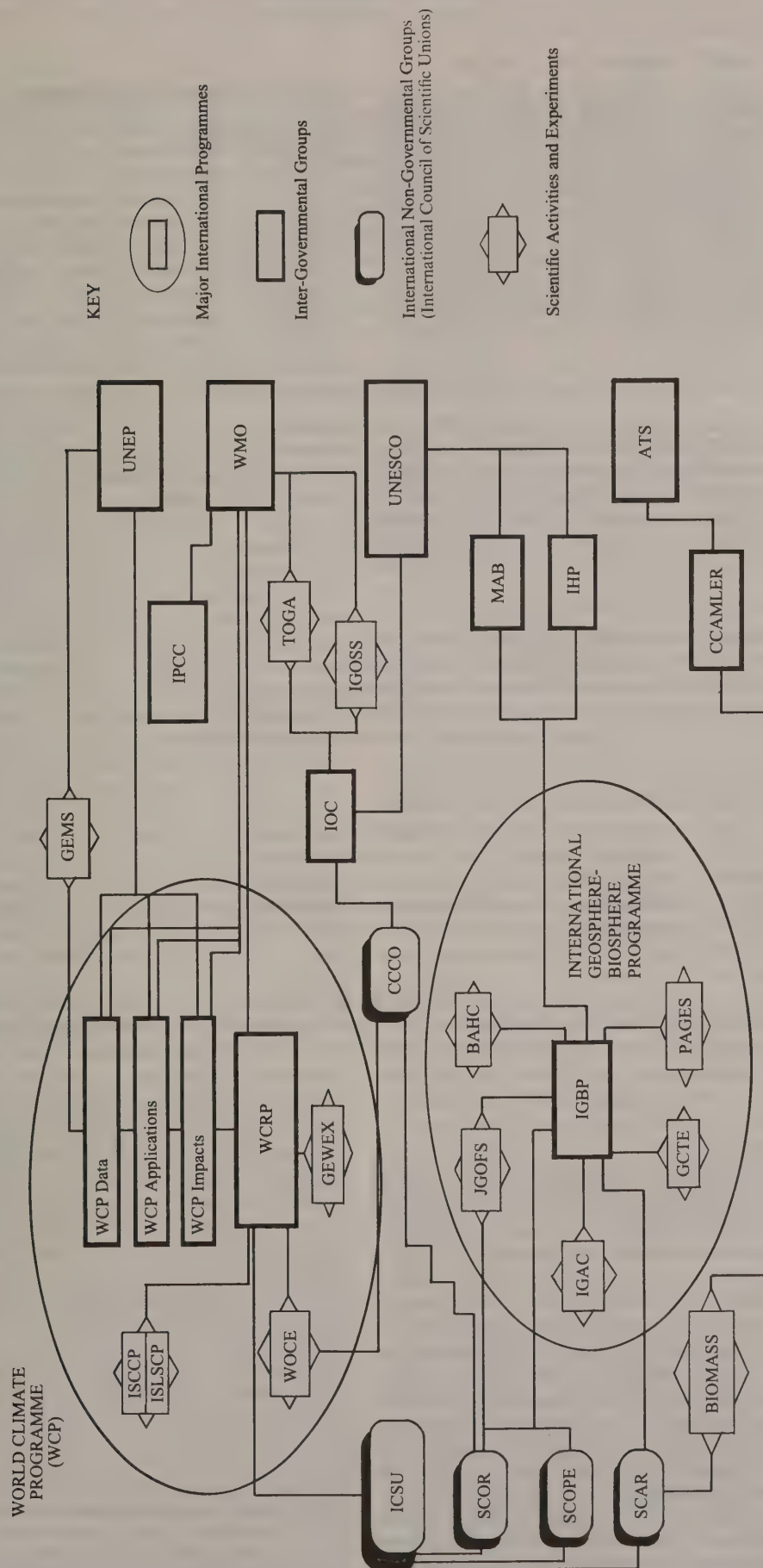
EC Programmes:

ESPRIT:	European Strategic Programme for R&D Information Technologies
FAR:	Fisheries and Aquaculture Research
EPOCH:	European Programme on Climatology and Natural Hazards
MAST:	Marine Science and Technology
STEP:	Science and Technology for Environmental Protection

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[Continued

International Structure of Global Change Programmes



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[Continued

INTER-GOVERNMENTAL ORGANISATIONS

ATS	Antarctic Treaty System
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
WMO	UN World Meteorological Organisation
UNESCO	UN Educational, Scientific and Cultural Organisation
IHP	International Hydrological Programme
MAB	Man and the Biosphere Programme
IOC	Inter-Governmental Oceanographic Commission
IGOSS	Integrated Global Ocean Services System
TOGA	Tropical Oceans Global Atmosphere Experiment
UNEP	UN Environment Programme
GEMS	Global Environment Monitoring Programme
IPCC	Inter-Governmental Panel on Climate Change

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (NON-GOVERNMENTAL)

ICSU	International Council of Scientific Unions
SCAR	Scientific Committee on Antarctic Research
BIOMASS	Biological Investigations of Marine Antarctic Systems & Stocks
SCOPE	Scientific Committee on Problems of the Environment
SCOR	Scientific Committee on Oceanic Research
CCCCO	Committee on Climate Change and the Oceans

WORLD CLIMATE PROGRAMME

WCRP	World Climate Research Programme
GEWEX	Global Energy Water Cycle Experiment
ISCCP	International Satellite Cloud Climatology Project
ISLSCP	International Satellite Land Surface Climatology Project
WOCE	World Ocean Circulation Experiment (CCCCO/WCRP)

INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME

IGBP	International Geosphere-Biosphere Programme
BAHC	Biospheric Aspects of the Hydrological Cycle
GCTE	Global Change and Terrestrial Ecosystems.
IGAC	International Global Atmospheric Chemistry Project
JGOFS	Joint Global Ocean Flux Study (SCOR/IGBP)
PAGES	Past Global Changes

Examination of Witnesses

DR EILEEN BUTTLE, Secretary, PROFESSOR J C BRIDEN, Director (Earth Sciences), and PROFESSOR P LISS, Council Member, Natural Environment Research Council, called in and examined.

Chairman

339. Dr Buttle, thank you and your colleagues very much indeed for coming to see us. I am sorry we kept you waiting but we had a very lively discussion with your fellow Research Council. Before you introduce your colleagues you may wish to make a statement. We are most grateful to you for the very clear written evidence which is very helpful. It might assist if I just try to sum up the three major points that have come out from a lot of the evidence we have got. The complaint has been made—but not actually always supported - that, leaving aside the European Framework Programme, in these major international programmes, which may come from abroad as suggestions to this country and where government departments are concerned, the machinery either is not the right machinery for co-ordinating everybody who is concerned—government departments, research councils and others—or that there is some sort of vacuum with the result that

it takes a very long time, particularly if the approach comes from overseas, to get an answer out of the British Government as to whether they are going to participate and, if so, how. That is one aspect.

I do not think you are very much involved in the European Framework Programme, so perhaps we can put that aside.¹ The other complaint is from the bottom up point of view, and on this we have had a mass of evidence from all sorts of different people. When they wish to start off on some international programme, or wish to take part in some international programme which has been suggested from overseas, they find it very difficult to find out how to set about it, what channels to use to get the

¹ *Note by the witness.* In a subsequent letter to the Sub-Committee (dated 30.10.90) and printed at page x, Dr Buttle corrected this mis-impression and outlined the extensive NERC involvement in the EC Framework Programme. In the Third Framework, NERC has an interest in, and has been consulted about, the programme content of the Environment, MAST and Human Capital and Mobility lines.

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and PROFESSOR P LISS

[Continued

team together and how to get the funds to get the thing approved. The third field really where there has been a lot of evidence is the Framework Programme. There is dissatisfaction with the financing arrangements which, as far as the European Framework Programme is concerned, has the general effect of reducing the money available to spend on things other than the Framework Programme. Some of that perhaps does not affect you so much,¹ but you are much more involved in much wider programmes. That is largely a summary of the evidence we have received. If you would like to introduce your colleagues.

(*Dr Buttle*) Thank you very much, my Lord Chairman. I am Dr Eileen Buttle, Secretary of NERC; I have on my left Professor Briden, Director of Earth Sciences; and on my right Professor Peter Liss who is a Professor of Environmental Science at the University of East Anglia, and is a member of our Council. What I would like to do is make a brief opening statement simply to say that the evidence you have had from SERC has probably been concerned principally with international scientific programmes where there is a sharing of facilities, and where there is a membership arrangement by subscription. Just to emphasise what we said in our written evidence, we have but one example which is the Ocean Drilling Programme, with which Professor Briden is intimately involved, so questions on that might suitably be addressed to him. We as a Council would like to introduce you to yet another model of the international science programme where there is no membership subscription in the formal sense, and where the commitment to participate is made by scientists themselves, not the funding agencies, in an international forum, but it is well known and understood that whether or not those scientists are able to realise that commitment depends entirely on their own efforts within their own national machinery for winning funds. The environmental sciences are particularly concerned with those types of programmes. There has been a long tradition in environmental sciences for programmes such as these. If I could give you an example to help, and that is the World Climate Research Programme which was initiated by the World Meteorological Organisation, which is a UN agency. That would have been spawned by that organisation but it would have been the scientists themselves internationally who would have drawn up the programme, and each would have come to its own national machinery for winning funds. I think it is important you understand that we ourselves as a Research Council see this as being an ideal arrangement because we feel that the whole as a result of that is greater than the sum of the parts. We feel there has been brainstorming which puts intellectual rigor on the scientific planning that comes out of that machinery, and that it avoids

duplication and it enables the UK scientists to share in facilities and often get access to areas they otherwise would not. It also in no way compromises our own process of setting priorities and focusing our funds. We try where possible to align our national planning with those international programmes because often there is a window of opportunity for participation which we must try and correlate with our own planning. I would like to finish my opening statement by emphasis on that type of programme, my Lord Chairman, which I think is different from the one you have been hearing about from SERC.

340. In your field did you find when the whole World Climate Research Programme got going there was any other machinery other than your own Research Council which was involved in having to make decisions about participation in that? Do you feel that there is a need in your field for any machinery above yourselves, as it were, to co-ordinate the activities of all concerned? Of course in the Met. Office you have a co-ordinating machine already. Would you agree with the criticism that there is a lack of proper co-ordinating machinery at the top, or what co-ordinating machinery there is does not work very well?

(*Dr Buttle*) I do not think we as a Council have evidence of the lack of that machinery. I do not know whether my colleagues have any evidence on that.

341. All your participation in the environmental programmes, which are worldwide or Europe-wide, is arranged by yourselves direct with the international organisation?

(*Dr Buttle*) It is an iteration. The organisations, such as the International Geosphere-Biosphere Programme which is generated by the scientific community (and I am sorry but there are many organisations which have such complicated titles) through the International Council of Scientific Unions, take the initiative and set up the planning. The advantage of this is that UK scientists can influence the planning process without the funding agencies having to make commitments in funding at that stage. They have a brainstorming to sharpen up those plans.

Lord Flowers

342. I see the advantages, especially to a research council, in a programme that is planned and funded in that way. You retain control over your own funds essentially. It does not look quite the same from the other end with the person trying to co-ordinate the international programme. He might like to have all the money in his own hands. The result of the process you have described is that very often the whole project goes at the pace of the slowest.

(*Dr Buttle*) I understand that point, Lord Flowers. I think that the difficulty with putting

¹ *Note by the witness.* The NERC role in EC Framework is outlined in the letter from Dr Buttle to the Select Committee (30.10.90).

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[Continued

[Lord Flowers *Contd*]

resources in the hands of those organising international programmes is that there is no definition of how those resources should be prioritised. Against what do you measure the priority of that programme?

Chairman

343. Do you find, because you are involved in a great many programmes that are worldwide programmes, that there is some difficulty in, as it were, balancing co-operation on a European basis, particularly a European Community basis, against the demands of co-operating on a world programme?

(*Dr Buttle*) Very often the European programmes are designed specifically to meet European policy requirements or have an European emphasis. Very often that is in harmony with what is trying to be achieved internationally. Rarely have I evidence of conflict there. It is largely a difference in emphasis, I think, in the sense that European programmes have, by and large, this narrower focus of addressing particular issues for policy requirements.

Lord Lewis of Newnham

344. What roughly is the percentage of your budget that is associated with these sorts of programmes?

(*Dr Buttle*) It is approximately 25 per cent. of our programmes budget. That is an analysis of how much of our budget is spent rather than a policy decision on our part to spend 25 per cent. of our budget in this way.

Lord Dainton

345. If I understand correctly, you are saying that most of your actions are in fact the result of what you call brainstorming, bottom up filtering, refining by discussion amongst the scientists in this particular area. Are there no policy guidelines that NERC gives to them as to areas which are preferred, or is it entirely reactive?

(*Dr Buttle*) No, I think it is iterative again in the sense that the NERC has published its strategies in many areas of its science. It is public knowledge what our strategies are in terms of our policy. UK scientists are, I believe, well aware of those strategies and then the Council would itself decide on its priorities for funding according to its own strategies and according to the timeliness of science in that particular programme. There are a number of programmes. They cannot all be funded; one country may well set its priorities to fund an element in one programme, and another country may not necessarily have that same emphasis. It is a problem, I imagine, for those planning the science to take the whole programme forward in an even way.

346. Does the fact that something might be proffered as part of an international programme

have any effect on your judgement, giving funds to it, say, if there are British scientists who have won partners in other countries? Does that affect your judgement favourably or unfavourably?

(*Dr Buttle*) I will answer, then let my colleagues add to this. In my judgement in the United Kingdom the fact that a project or programme is put to the Council for funding and alongside it has an asterisk that says it is part of the IGBP programme or other international programmes would be an added bonus, but it would not have an inside track because of that, it would be viewed in the context of the other sciences.

(*Professor Briden*) I think that is right. It would not affect our judgement on it but it would affect the course of action that we would take, because if a particular opportunity is presented which our own scientists do not seem to be picking up spontaneously, we may draw it to their attention. We may hold a workshop meeting and take advice on the outcome. A good attendance is indicative and a bad attendance would be indicative too.

(*Dr Buttle*) Perhaps Professor Liss could help with the bottom-up approach, the worry about whether they know what is going on.

(*Professor Liss*) Could I comment particularly from the point of view for IGBP, the International Geosphere Biosphere Programme. The Secretary has already mentioned to you this programme which has been proposed by ICSU, and British scientists have been very much involved with the formulation of the programme. Now, when it comes, what should be the United Kingdom's participation in that? There are two things that have to happen. The scientists have to say whether they think it is a good programme and which elements of it they wish to contribute to. We have tried to find a mechanism for doing that. We have a meeting in November at the Royal Society where the programme of IGBP will be talked about by British scientists mainly and they will propose what the United Kingdom contribution might be and then there will be time for discussion from the floor as to whether people agree with that statement of where the United Kingdom effort might be put. Now, depending on the success of that meeting—and one of the successes would be if a lot of people turn up; the negative would be if few people turn up—the Research Council will obviously be looking at and listening to very much what the scientific community are saying and, depending what message they get, they will then have to think what the final situation in regard to the various proposals of IGBP is. So really it is a two-way process. Clearly the Research Council is well aware of these programmes, but they also have to know what the scientists feel, then the two have to be brought together.

Chairman

347. If somebody working perhaps in a small part of the field—perhaps in your field—thinks "Well, this work I am doing could be of use in one

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and PROFESSOR P LISS

[Continued

[Chairman *Contd*]

of these big programmes like IGBP or something else", and of course would like to see it funded that way, how would you set about it?

(*Professor Liss*) If I can just continue the process I think will happen with IGBP, I think after this meeting on 16th November—assuming there is a positive response generally to that meeting—the individual components of IGBP, of which one is the International Global Atmospheric Change Programme, another is JGOFS which is up and running (about five of them are presently established) there will be sub-groups formed within the United Kingdom and the Community to discuss those particular projects in detail. The Atmospheric Chemistry Sub-Group will meet among themselves and that is where the younger people and the active scientists who might not be part of the decision-making process normally will have their say, at that smaller group meeting. That will come forward with some recommendations for what the United Kingdom's contribution to that particular component of the IGBP might be. The funding agency has to be involved because nothing is going to happen without money to make it happen.

348. This is separate from the great summit meeting on the greenhouse effect, is it?

(*Professor Liss*) Yes, this is a purely UK meeting.

349. If that comes up in the recommendation, that a great deal more scientific effort should be made in certain fields, what would be the machinery then for agreeing which country was going to put how much effort into which fields, or will it all be left to a purely reactive answer to that?

(*Dr Buttle*) My Lord Chairman, we actually have an informal grouping of funding agencies of some of these international programmes whereby I represent the research agencies in the United Kingdom and the United States would have NSF membership there, where we do indeed informally discuss which country is participating in which way. So there is a network between the funding agencies engaged in these programmes, there is also a network between the scientists and those involved in planning, and when I say planning it is a structured planning. For example, the United Kingdom hosts the International Planning Office for the World Ocean Circulation Experiment. Most of these programmes have planning officers and some small amount of funding has to go in that direction. They are sophisticated in their planning; in that sense they themselves are clearly articulate in saying there is a gap here, or this country has this facility, or this expertise, and they would let the Research Councils know. But there is always, if I may say this finally, my Lord Chairman, nothing to stop an individual scientist with an individual project or programme going to the responsive mode mechanisms through the Research Councils to have his science funded irrespective of whether he is part of the international programme or not. There is no bar to his taking that route.

Lord Adrian

350. Are the DOE and DES, as it were, aware of these programmes and do they have any input with you in terms of influencing the Research Council to support them or to devote more resources to one rather than the other, and so on?

(*Dr Buttle*) The DOE, of course, is represented on our Council and in all our science committees, by which we operate. The Departments are represented, so they are well informed of the progress of these programmes and they, indeed, do participate. To give you an example, we have recently had a programme on the North Sea where there was a steering committee for that programme and the Ministry of Agriculture and the Department of the Environment were represented on that committee.

Lord Nelson of Stafford

351. Does that enable you to get your decisions quickly enough to match your Continental colleagues who have ministers of science who co-ordinate the decision-making?

(*Dr Buttle*) The decisions on funding, if we are using our own resources, can be made annually and—

352. I was thinking of decisions to participate.

(*Dr Buttle*) This is not a question of paying up, this is a question of funding those participating in the science that can be taken at individual level or can be taken as part of a larger United Kingdom programme. Now, as I said earlier, there can be difficulties of timing in terms of assembling the case—if we are going for extra funding—for the United Kingdom part of an international programme. We have to get our timing right so that we get our funding for that at the time that the window of opportunity in the international programme. That is a problem sometimes.

Lord Nelson of Stafford] If you take the international drilling programme as an example, we made our decisions long after everybody else, in fact, they despaired of getting a decision out of us.

Lord Shackleton

353. Turning to the International Geosphere-Biosphere Programme, we talked about this a couple of years ago as a possible subject for this committee to examine. It would have been a bit premature. I get the impression, if I may give another example, that much of your work is bottom up and not handed down in any way. If I give another example, fisheries research. I recently read a very lengthy paper produced by an Australian scientist doing fishery research in the Antarctic which ties in very much with the research being done by our fishery researchers in our section of the Antarctic. Do you have any impact on any of that at all? You have to fund BAS. I am not sure how far this research is BAS research and how far it is Ministry of Agriculture. This is bound to come to you when they have their

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[Continued

[Lord Shackleton *Contd*]

ideas rather from you to them, is that so? I look again at your proposals for £2m to be spent in the Arctic, which I think got squashed by the Treasury and that was largely bottom up, was it, or am I wrong?

(*Dr Buttle*) I think, my Lord Chairman, that it is both ways. It is a two-way process. We try very hard as a Research Council to spot the timeliness of the science, when the science is right to be funded, and when it is of strategic significance; that is our role. We do take initiatives. We have what we call community research projects where, for strategic reasons, we have selected an area of research—the North Sea was such a programme. For the North Sea, we saw the development of a water quality model as being of scientific strategic importance.

354. Scientists have been talking about the North Sea for quite a while?

(*Dr Buttle*) Exactly, but we laid emphasis on that. The community research programme is designed to bring those scientists in the higher education institutions, institutes and in government institutions together. That is the purpose of the steering committee. We are not solely responding to the scientists themselves; we do actually take a specific direction and then engage them in that.

Lord Lewis of Newnham

355. Do you have any commission work from the DoE, or any direct monies coming from the DoE or MAFF to do a particular piece of work?

(*Dr Buttle*) Yes.

356. It seems to me that is a very important source of money to you, which is really a commission type of work?

(*Dr Buttle*) Yes.

357. Could I ask you a supplementary to that, going back to Lord Flowers' question. The way you are talking, it seems to me, you have a great opportunity of withdrawing from certain programmes if you decide to rather quickly, much more quickly than if you have invested in, say, CERN, as SERC has done. How rapidly do you withdraw from programmes? Are there many programmes you have been involved in and withdrawn from because you put higher priorities for your money in other directions? What is your flexibility? How does that leave the organisation that has primarily been running that particular programme?

(*Dr Buttle*) I will ask Professor Briden to talk about ODP specifically in terms of flexibility and then respond in terms of the other programmes.¹

¹ *Note by witness:* When we join an international programme we do so with the intent of seeing it through. But intent falls short of being irrevocable commitment, performance, a major drop in national scientific priority or extreme financial crisis. In the case of ODP, withdrawal is possible on 12 months notice on 30 September each year.

(*Professor Briden*) May I just answer Lord Nelson's question, which I did not get a chance to do earlier, because you properly raised the example of the lateness of Britain joining ODP. In my view the lessons to be learned from that episode are not structural ones, so much as how to make decisions in difficult circumstances, in particular what to do when you are short of money. The other lesson I drew from that episode was identifying the criteria, the reasons why you would wish to be in a particular programme. Looking back on it I think that was not clearly identified at the time. The motivation was and should have been identified as a pure science motivation which had other spin offs to it. In the scramble for the last few percent of money, which was eluding the Science Budget at the time, that issue was confused.

Lord Nelson of Stafford

358. There was no machinery for doing it at that time?

(*Professor Briden*) I think that the machinery was there. The machinery that ought to have worked would have been the science vote route. The reason why it was difficult—we are talking about 1985 was that there was very extreme pressure on the science vote. If I had to do that again then I would advocate making the case very clearly on scientific merit.

Lord Adrian

359. Of course at that time the scientific merit was not quite so popular in the highest circles as it has subsequently become. Presumably you cut your coat according to your cloth.

(*Professor Briden*) You were calling for an answer!

Lord Flowers

360. I think Professor Briden has the sympathy of all of us. Could I ask a question which I think I probably should have put to SERC as well. The complaints we hear about persistently are not that individual scientists find it difficult to approach a research council and get a discussion on what it is they want to do and get a sympathetic response for that matter, not at all. It is that after things have been discussed they then move upwards into unattainable regions of government as far as individual scientists are concerned, and all these discussions are going on between you and the departments and so on. It appears to the individual scientists, and it appears to me very much, that there is no enthusiasm in government for getting involved in scientific projects at all, and certainly not international ones, because it is nobody's job in government to be enthusiastic about such things. Unless there is a focus for enthusiasm you do not expect to get an answer out of government unless you become so pestilential that somebody has to give an answer to get rid of you. That is the impression

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[Continued

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that is given to the individual scientists and to me. Do you have any comment if you think it is an unfair judgment of the individual scientists?

(*Dr Buttle*) My Lord Chairman, I am disappointed because I believe that it is the very mission of NERC to be enthusiastic about environmental research which has to be international. The environmental science is not confined by national boundaries. If we as a Research Council see one particular element of international science as being our first priority we are able to respond by giving that our priority with our own funds.

361. Providing government permission or additional funding or something is not required?

(*Dr Buttle*) We do not need government permission to participate in international programmes that I am talking about provided we use our own funds.

362. That is why I should have asked the question of SERC.

(*Dr Buttle*) If we are going into an international programme like ODP for its science then we do not need the permission of government to do that. It is when we are seeking additional funds through the DES that this nervousness might appear. It is a nervousness that comes because of the danger of lack of flexibility, a worry that one has not got the flexibility to retract if circumstances or priorities change. We have in the ODP the option to give a year's notice to withdraw—we would do that reluctantly, but we do have the option to withdraw.

Lord Flowers] You do not think in the upper reaches of government there is a lack of enthusiasm to take part in international scientific programmes—not in the NERC, in government?

Lord Shackleton] Is Lord Flowers referring primarily to the Research Councils, ministers or what?

Lord Flowers

363. I thought I had made it rather clear, my Lord Chairman. I am not trying to blame the Research Councils—but those to whom they are responsible.

(*Dr Buttle*) In our experience we have not encountered that reluctance, but we do not participate in CERN.

Lord Dainton

364. The characteristic of NERC is that the largest fraction of its funds was transferred some time ago. I would like to ask firstly what the proportion of your total income now is on commissioned research and has that changed? Has the change put you in anything like a straitjacket in what you would want to do in confining you, because some of this work you speak about is in the national interest of departments and, therefore, requires their approval. Have I made myself clear?

(*Dr Buttle*) The second part —

365. Because you have insufficient funds, shall we say, because so much was transferred, therefore you have a high percentage of your income which is commissioned work, the decisions about which are taken by departments—does that handicap your international activity?

(*Professor Briden*) As to the transfers that you are referring to, Lord Dainton, the history of that is getting lost in the mists of time to us now.

366. The financial consequences are still with you, are they not?

(*Professor Briden*) But they do not impinge on the way that we analyse our budgets and our actions at the present time. We have a very large slice of commissioned work with government departments. I think the answer to your question is the proportion of our funds that come from outside DES is some 30%.

367. Does any of that go to international programmes?

(*Professor Briden*) No, that is the point, that it impinges very little. The one part that does, or can, impinge is precisely directed to that, and is the overseas work through the Overseas Development Administration. Otherwise, there is not a lot of impact between those two things. That is why I said in day-to-day terms to us the two do not impinge.

Lord Shackleton

368. It did take the intervention of the Prime Minister to ensure the British Antarctic Survey got the money they needed.

(*Dr Buttle*) I would rather not comment, my Lord.

Baroness Nicol

369. You referred earlier to the participation of MAFF and DOE. I was not quite clear at what level this participation took place. Could you say a little more about it? Does it amount to scientific participation or is it by way of being political—with a small “p”—guidance?

(*Dr Buttle*) It happens at all levels. We have the Chief Scientists of DOE and Ministry of Agriculture on our Council. Then we have main science committees which carry out the business of Council and we would have representations from government departments on those as well. But then when we are actually running science programmes we have steering committees and you would find on those steering committees members of those departments who are actually scientists themselves, working in the government laboratories as well as people in the Chief Scientists group who are interested.

(*Professor Liss*) Could I just add to that that from the point of view of the North Sea, the Community

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[Continued

[Baroness Nicol *Contd*]

programme NERC is running, on that committee there are representatives of the Department of the Environment and the Ministry of Agriculture, Fisheries and Food. They are active participants in the planning but also active participants in the work going on, particularly in the case of the Ministry of Agriculture, Fisheries and Food because, as an example the programme requires a research vessel committed for 15 months to the North Sea, but on one occasion at least we needed two vessels for a particular experiment and MAFF provided the second vessel. We had two NERC vessels from a very small fleet in one place at one time. So that was very helpful and in terms of facilities they certainly helped us with measurements and other scientific parts of the programme. That has been very fruitful.

370. This assistance comes completely funded, does it?

(*Professor Liss*) Yes, all that assistance came completely funded by that Ministry.

Chairman

371. One of the subjects which interests us (it does not affect you very greatly, as you said in your paper) is the advantages and disadvantages of hosting international programmes. There is one aspect about which I would like to ask you. At Wormley, for instance, where you are acting as an international data centre, are there any problems associated with acting as an international data centre which are difficult to solve?

(*Dr Buttle*) So far as I am aware, there are many problems about data centres but it is not their international nature that poses the problem.

372. Does not the fact that it is used by a whole lot of people cause you problems?

(*Dr Buttle*) Not any specific problems, my Lord. I think that in harmonisation and comparability of data and how it is assimilated and analysed there are huge problems in that area.

373. But nothing you, as hosting, would see with one of your research vessels sharing with other nations?

(*Dr Buttle*) We have in place an international committee for research vessels in the scientific community where there is an exchange of information about each country's fleet and also where we can share facilities. For example, scientists can be accommodated on an American or German ship for a particular cruise if that ship happens to be better placed to help in the sense of being geographically in the right part of the sea.

374. You are happy about the international arrangements in this field generally. You are very much concerned with monitoring programmes and with a great deal of exchange of data on an international basis. Are you happy that the arrangements for this are on the whole good?

(*Dr Buttle*) I think we can say yes.

Lord Shackleton

375. Are you spending enough money in support of geographical information systems, which is a very big subject? There is not a body other than a voluntary body doing it in comparison to the French. I do not know whether you have been asked.

(*Dr Buttle*) My Lord, we have indeed taken initiatives in GIS and I am sure there is more to be done in that area, and we are continually having bids for more funds within the Council, never mind outside, for this very important subject.

Chairman

376. In general you feel the international arrangements which are behind the world research programme in that new field generally work as well as could be expected and that on the whole they seem to work better than many other engines of the same sort?

(*Dr Buttle*) I would not dare to be complacent, my Lord Chairman, but I think we do not have the same problems as others do with the sharing of facilities. Where there are subscriptions we could have that problem such as with ODP. Indeed, we do have problems of exchange rate fluctuations, of the fact that we have to make a commitment to that programme and annually we have to confirm that we are going to be in for another year before we actually have time to consider it in context because it is out of phase with our own planning cycle in the Council; but because it is a relatively small part of our budget it does not give us the problems other Councils might have. In terms of the international collaborative programmes I am talking about, yes, of course, there are bound to be areas where there could be improvement. By and large I do not think they constrain us to the extent that we would be worried about them.

377. You do not see the need for any new international programme in your view?

(*Dr Buttle*) I think we have enough, my Lord Chairman.

Chairman] Thank you very much indeed, Dr Buttle. It has been very interesting and has thrown a rather different light on the whole subject from that we have had from a lot of other evidence.

25 October 1990]DR E BUTTLE, PROFESSOR J C BRIDEN
and PROFESSOR P LISS[Continued

Letter to the Clerk from the Secretary of the NERC

Dear Dr Walters,

When I gave evidence to the Select Committee on 25 October, I gained the impression that the Chairman (Lord Carver) believed that NERC was not greatly involved in EC science programmes.

I should like to correct any possible misunderstanding in this regard. NERC has been a successful research contractor to the European Commission for many years and the list of current contracts in Section E of the Annex to our memorandum demonstrates NERC's success and the range of its involvement. Indeed, NERC recognised the importance of developing good contacts with the Commission at an early stage following the UK's accession to the European Communities and established a liaison office in Brussels. This office has been expanded over the past few years to include the other research councils and a large number of Higher Education Institutions.

NERC has been involved in discussions on the planning of the Framework Programme. In particular, we have been closely involved in the formulation of the MAST programme and have been involved in planning for the Environment and the Human Capital & Mobility programmes.

NERC is a member organisation of the European Science Foundation and plays a full part in its activities and is actively involved in many of the ESF Network and Associated Programmes initiatives. Elsewhere in Europe, we have participated in Council of Europe activities and we have a number of bilateral arrangements with agencies in several European countries.

I trust that this information will assist the Committee.

Yours sincerely
Eileen Buttle

MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY

(SUB-COMMITTEE II)

Thursday 8 November 1990

DEPARTMENT OF TRADE AND INDUSTRY

Dr R Coleman and Mr R Foster

DEPARTMENT OF EDUCATION AND SCIENCE

Mr R P Ritzema and Mr K Root

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THURSDAY 8 NOVEMBER 1990

Present:

Carver, L (Chairman)	Shackleton, L
Kirkwood, L	Sherfield, L
Lewis of Newnham, L	Taylor of Blackburn, L
Nicol, B	

Memorandum by the Department of Trade and Industry**INTRODUCTION**

1. The DTI supports UK participation in a number of international collaborative programmes. Europe inevitably provides the main focus given our membership of the EC and the lead up towards the completion of the Single Market. The main “umbrella” programmes in which our efforts are focused are the European Community Framework Programme, EUREKA and the European Space Agency (ESA) which DTI supports through the British National Space Centre (BNSC). We are also involved in the COST programme and in a number of specific activities such as EUROMET (covering measurement facilities), the European Transonic Wind-Tunnel and the European Synchrotron Radiation Facility. However our European focus does not preclude participation in large collaborative programmes involving countries outside Europe, either bilaterally or multilaterally, where this is appropriate.

POLICY BACKGROUND

2. The Secretary of State for Trade and Industry has responsibility for research and technology policy relating to the industrial and commercial field. The Minister for Industry and Enterprise is responsible for representing the UK on the Research Council in negotiations on the European Community’s Framework Programme. These responsibilities relating to international collaboration are discharged alongside the DTI’s domestic responsibilities for innovation policy, technology transfer and improving links between academia and industry.

3. The DTI supports UK participation in international collaborative R&D programmes where there is a clear rationale based on the principle of subsidiarity. Important factors include the wider benefits which would accrue as a result of international collaboration and which would not arise from purely domestic collaboration—for instance through pooling of resources and access to complementary scientific and technological expertise from outside the UK. Such benefits include research leading to the development of standards and codes of practice which promote international competition. International collaboration can provide alternative sources of funding which UK organisations are encouraged to take advantage of, but there are other significant benefits to the UK for example the speed, cost and quality of the research conducted in comparison with what would be possible at a purely national level. Collaboration in international programmes can result in new approaches and solutions to a multiplicity of scientific and technical problems. Participation in such programmes can also be of value to the UK and to the industrial participants because of the opportunities for inward technology transfer and the access it provides to the results and intellectual property rights produced by the other collaborators.

4. In determining its stance on a range of international R&D collaborative activities, the DTI recognises the importance of the Treasury/Cabinet Office guidelines. However, these guidelines do not apply to UK involvement in the Framework Programme, as our participation is mandatory under the Single European Act. In considering *international programmes* outside the Framework Programme the participation in DTI follows the procedures in the Cabinet Office guidelines, emphasising in particular the following aspects of a programme:

- it clearly provides added value in terms of the scientific/technological quality of the proposed research above and beyond what would be achieved by conducting the work concerned in the UK;
- it complements not duplicates national (and existing international) research programmes;
- it reflects UK technical priorities and industrial strengths in the area concerned, with respect to the other collaborators, in order to ensure the UK secures a balanced share of the financial benefits of both participation *and* exploitation of the results of the programme (clear IPR arrangements are therefore important);
- it helps to improve industrial competitiveness, preferably in the short to medium term, for example by developing standards and common user functional specifications which help industrial efficiency and reduce barriers to trade;
- it encourages two-way technological awareness and thus technology transfer in the area concerned, with the aim of securing maximum commercial benefits for UK companies;
- it provides wider commercial opportunities for the UK companies involved through the improved trade relations and market opportunities arising from S&T contacts with overseas collaborators;

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- it has a clear strategy and management structure, and testable objectives where possible, with appropriate mechanisms for terminating participation at both the company and the national level.

5. The DTI supports the hosting of *large facilities* in areas where the UK has technological or scientific expertise, or where the potential commercial benefits are judged to outweigh the additional costs and resource implications. However, the DTI recognises that the UK cannot hope to lead in *every* area of science and technology, and that selectivity is of paramount importance.

6. The machinery for establishing most of the international programmes and projects in which the Department is involved is determined by the nature of the programme itself and the UK objectives and priorities. The Framework Programme has a top-down approach in which programme areas, objectives and priorities are defined in advance with industry submitting collaborative projects for Community support. By contrast EUREKA is a bottom-up and industry led mechanism. Projects are proposed, managed and developed by industry itself, with DTI guidance and financial assistance where appropriate. EUREKA projects can encompass nearer market R&D and offer the potential to exploit some Community R&D. DTI recognises that international collaboration under whatever banner inevitably involves a degree of bureaucracy and in the case of EUREKA is taking steps to streamline its domestic procedures (whilst maintaining their rigorousness) and to promote greater awareness of the opportunities which it offers.

7. There are no over-riding impediments in the UK to participation in international scientific programmes. In each particular case the advantages are weighed against the disadvantages and bearing in mind the Treasury/Cabinet Office guidelines. Overall financial constraints on public expenditure ensure that value for money and complementarity are properly addressed by the Departments concerned.

EUROPEAN COMMUNITY RESEARCH AND DEVELOPMENT FRAMEWORK PROGRAMME

8. The European Community's Framework Programme for Research and Development is the largest international collaborative programme in which the UK is involved. The Framework Programme sets a five-year "umbrella" strategy and budget for a range of science and technology programmes. The current Framework Programme II runs from 1987-91 with a funding ceiling of 5.4 billion ECU (£3.6 billion). The recently agreed Framework Programme III will interlock with this, running from 1990-94 with funding of 5.7 billion ECU (£4.2 billion). Approximately 50 per cent of Framework III funding is information technology, telecommunications, telematics, and industrial and materials technologies—though the DTI also has an interest in programmes covering environmental technology and biotechnology.

9. The co-ordination of Government policy on the EC Framework Programmes reflects this multiplicity of interests within individual Departments. The Secretary of State for Trade and Industry has overall ministerial responsibility. He is assisted in this role by the Cabinet Office's Science and Technology Secretariat under the Chief Scientific Advisor, which co-ordinates work relating to international science and technology at both Ministerial and official level within Government. The S&T Secretariat also sends representatives to the EC's Scientific and Technical Research Committee (CREST) and is the formal liaison point with the UK Permanent Representatives.

10. Negotiations on the EC Framework Programme differ fundamentally from those on other international collaborative programmes in that under the Single European Act UK participation is mandatory. The UK's negotiating stance on the Third Framework Programme was based on the need to ensure as far as possible value for money, balanced advantage to the UK's industrial and science base, and complementarity with existing national and other international programmes. Policy responsibility for the specific programme lines under the Framework falls to individual Departments broadly in accordance with their areas of domestic policy responsibility. A lead Department is identified, which may subsequently operate in conjunction with one or more other Departments who share an interest in the work area involved. The lead Department is responsible for preparing the UK's policy line (consulting inside and outside Government at each stage as necessary) and representing the UK in negotiations both on the detailed technical contents of each individual programme and, once programmes have been agreed, on the appropriate management committee which oversees the implementation of the specific programme. During negotiations, and during the life of the programme, DTI ensures that the views of industry are taken on board as far as possible in setting the work plan of the programme; and that potential commercial applications of the work are actively under consideration at an early stage. Industrial input occurs through the formal committees established to advise the Department, informally from companies or individuals and through bodies such as ACOST. The Commission, when preparing the programme proposals, also consults widely with European industry. Formal discussion of proposals occurs through the Council's negotiating machinery which culminates in proposals being submitted to Ministers in the Research Council.

11. Once the programme is agreed and has started running, the lead Department is responsible for publicising the opportunities it affords in the UK, monitoring its progress and steering its direction in the

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relevant management or advisory committee. Programmes are evaluated at their mid point and on completion. A list of the key programmes under both Framework II and Framework III for which the DTI has lead responsibility is at Annex B. Publicity for R&D opportunities occurs through such means as departmental literature (e.g., the DTI's EC R&D Guide), and through seminars arranged by DTI line Divisions. The Commission itself also widely publicises the programmes through its journals and in the press.

OTHER EUROPEAN PROGRAMMES

12. EUREKA is a pan European initiative involving 19 European countries (12 EC, 6 EFTA plus Turkey and the European Commission) in industry-led projects in advanced technology products and processes. The initiative is complementary to the EC Framework Programmes, but it provides an opportunity for collaboration in nearer market research and development and for market-opening measures through development of standards. DTI has lead responsibility in Government for EUREKA given its industrial focus, and DTI offers domestic funding for EUREKA projects in appropriate cases. The Department recognises the importance of EUREKA and is taking steps to raise industrial awareness of its potential as a collaborative mechanism. DTI is seeking to establish clearer ground rules for domestic support in order to encourage UK industry to participate in EUREKA projects, which are announced at annual Ministerial Conferences.

13. ESA (the European Space Agency) aims to promote peaceful co-operation between its participants in space research and technology and their applications. The Membership consists of nine EC countries together with Austria, Switzerland, Norway and Sweden. Finland and Canada are associate members. ESA is the largest single international R&D programme to which the UK contributes. The British National Space Centre (BNSC), a partnership of eight Departments and Research Councils, acts as a focus for the Government's civil space activities. BNSC is responsible for formulating and implementing policy and handles the crucial interface with ESA. The Secretary of State for Trade and Industry has lead Ministerial responsibility for civil space. ESA funding operates on a "core plus menu" basis, with mandatory contributions to the ESA science programme and general budget with optional involvement in individual programmes beyond this. The UK government sees collaborative research through ESA as of central importance to UK activity in this field. The UK policy emphasises the selective approach, concentrating on supporting those optional programmes which offer the most promising commercial and environmental prospects in the longer-term. The UK has recently, for example, secured leadership of the Columbus polar platform, the design of which will be important to the UK's longer-term plans for commercial exploitation of Earth observation. The House of Lords Select Committee on Science and Technology has examined UK civil space policy separately over the last three years and most recently took evidence in May 1990 on the current position from Mr Douglas Hogg, Minister for Industry and Enterprise.

14. The EUROMET programme aims to formalise co-operation in order to provide a wider range of measurement facilities and services to the European participating countries at a lower cost than would be possible at the national level. The participants include 18 National Metrology Institutes or measurement standards Laboratories in Western Europe, together with the European Commission, which participates on an equal footing with the other organisations involved. This collaborative programme was initiated by the UK and is governed by a Memorandum of Understanding which was signed in September 1987. The UK participant is the National Physical Laboratory, which keeps other DTI Divisions and Government Departments informed of the programme's activities as necessary. EUROMET plays an important role in developing measurement standards to support emerging technologies in Europe.

15. COST (Co-operation on Science and Technology) is a concerted action programme involving the 19 European countries. COST operates through co-operative projects, providing a mechanism for a variable number of participants to concert their research activities in an area of common interest and exchange the results amongst themselves. There is no formal statute or treaty governing COST, which allows it to operate under flexible rules agreed by the participants. Funding is the responsibility of the participating research institutes or companies and administration is carried out by the European Commission. COST participants are often public research bodies, although industry and academia also take part. New research areas under COST are proposed by any participating country, and, subject to agreement between at least four Member countries, a memorandum of understanding is signed. A project management committee is then set up to implement the proposed activity.

16. Co-ordination within the UK is the responsibility of the Cabinet Office S&T Secretariat, which represents the UK on the COST Senior Officials Committee. Other Government Departments are consulted on proposed areas of COST research within their field of interest. The DTI is involved in a number of projects of industrial interest and is consulted on other projects with commercial applications as appropriate.

17. The European Transonic Wind-tunnel (ETW) is a major international facility which is jointly funded by the MOD and the DTI. The ETW is a collaborative project currently in its construction phase. It is

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[Continued

operated as a private company (ETW GmbH) and supported by the UK, France, West Germany and the Netherlands to build and operate a cryogenic (low-temperature) wind-tunnel at Cologne. The objective is to have a test facility available to industry by 1997 which will represent full-scale flight conditions. This facility will thus result in significant benefits for the European aircraft industry by improving its design testing capability. DTI and MOD are represented on the ETW Supervisory Board and work closely on all matters. DTI's financial support to the project forms part of the Civil Aviation and Aeroengine Research and Demonstration programme (CARD).

BEYOND EUROPE

18. DTI sees Europe as the focus for its support of international collaborative R&D, both to ensure UK industry is well-placed to take advantage of the opportunities of the Single Market and to increase its competitiveness in world markets. However, DTI also encourages UK companies to collaborate with their counterparts outside Europe, for instance in the USA or Japan, where it is in their commercial interests to do so. Here the DTI role is primarily to facilitate the formation of such commercial contacts and collaboration and to help ensure that UK companies are aware of the opportunities and technologies available to them. In general, the DTI seeks to achieve this by more informal means although specific bilateral agreements do exist. In this context DTI supports enabling measures—for example the OSTEMS (Overseas Science and Technology Export Mission Scheme) which is designed to bring UK companies into contact with their overseas counterparts in related technological fields with the aim of learning about overseas technological practice and encouraging technological collaboration.

RTP4A

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ANNEX A

DTI CONTRIBUTIONS TO INTERNATIONAL SCIENTIFIC PROGRAMMES¹

	Estimate 1989-90	£ million Provision 1990-91	Planned 1991-92
EC R&D Budget ²	96	124	141
Space ³	80.1	88.8	96.1
EUREKA	5.6	9.0	11.0
European Transonic Wind tunnel ⁴	4.7	5.9	8.4

¹ This table shows expenditure on the major scientific collaborative programmes in DTI's field of responsibility. The COST initiative comes under the overall responsibility of the Cabinet Office.

² Based on the indicative UK contribution to the EC Budget in respect of R&D [Source: p. 48-49 of the Annual Review of Government Funded R&D]. The DTI's 56 per cent share of the UK total is shown here.

³ DTI funding of Space R&D, primarily through the European Space Agency [Source: Annual Review of Government Funded R&D].

⁴ Jointly funded by DTI and MOD-DTI contributions *only* are shown above.

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[Continued

ANNEX B

KEY INDUSTRIAL PROGRAMMES FOR WHICH DTI HAS LEAD RESPONSIBILITY UNDER THE SECOND EC FRAMEWORK PROGRAMME (1987-91)

- (i) *ESPRIT* (European Strategic Programme for Research and development in Information Technology).
Objectives—to provide the European IT industry with the basic technologies it needs to be competitive in world markets;
—to promote European industrial collaboration in IT;
—to contribute to the development of internationally accepted IT Standards.
Status —a five-year programme (1988-92) with funding of 1,600 MECU.
- (ii) *RACE* (Research and development in Advanced Communications Technologies in Europe)
Objective —to help to lay the foundations for a strong Community manufacturing industry in integrated broadband communications (IBC) through the development of the necessary technological base and open standards.
Status —a five year programme (1988-92) with funding of 550 MECU.
- (iii) *BRITE-EURAM* (Basic Research in Industrial Technologies for Europe/European Research in Advanced Materials:
Objective —to enhance the competitive position of the Community's manufacturing and materials industries in world markets, through support for collaborative research to provide the industrial and materials technology base required for innovative product and process development.
Status —a four year programme (1989-92) with funding of 499.5 MECU.
- (iv) *Raw Materials and Recycling Programme*
Objective —to help enhance the international competitive position of the Community's industries involved with raw materials and recycling. It will include primary raw materials, the recycling of nonferrous and strategic metals, forestry and wood products, and the recycling of waste.
Status —A three year programme (1990-92) with funding of 45 MECU.
- (v) *BRIDGE* (Biotechnology Research for Innovation, Development and Growth in Europe).
Objective —to strength the scientific base of Europe's biotechnology, and hence improve its international competitiveness, by fostering transnational and normative research.
Status —A four year programme (1990-93) with funding of 100 MECU.
- (vi) *BCR* (Community Bureau of Reference Programme)
Objective —to improve the reliability of chemical analyses and physical measurement (applied metrology) so as to eliminate discrepancies which may hinder the development of the Single Market.
Status —A five year programme (1988-92) with funding of 41 MECU.

KEY INDUSTRIAL PROGRAMMES FOR WHICH DTI HAS LEAD RESPONSIBILITY UNDER THE THIRD EC FRAMEWORK PROGRAMME (1990-94)

Line 1: Information Technologies

- Objective* —to continue the work of the ESPRIT programme in strengthening the technological base of the Community's IT industry, with particular emphasis on standards and the integration of technologies.
- Status* —proposed funding of 1,352 MECU over five years. Detailed programme contents under discussion between Member States and Commission. Council Decision to follow.

Line 1: Telecommunications Technologies

- Objective* —to enable the developing integrated broadband network to be constructed on open standards and to include new integrated services.
- Status* —proposed funding of 489 MECU over five years. Detailed programme contents under discussion between Member States and Commission. Council Decision to follow.

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[Continued

Line 1: Telematics Systems

Objective —to ensure the interoperability of systems, peripherals and telematic networks at a trans-European level, by means of prenormative research and validation of common functional specifications.

Status —proposed funding of 380 MECU over five years. Detailed programme contents under discussion between Member States and Commission. Council Decision to follow.

Line 2: Industrial and Materials Technologies

Objective —to contribute to the rejuvenation of European manufacturing industry through: basic technological research, the integration of new technologies into the industrial production process, research to establish standards and codes of best practice, and harmonisation of measurement and testing methods.

Status —proposed funding of 888 MECU over five years. Detailed programme contents under discussion between Member States and Commission. Council Decision to follow.

Examination of Witnesses

DR R COLEMAN, Deputy Secretary, Chief Engineer and Scientist, and MR R FOSTER, Head of International Science and Technology Branch, Department of Trade and Industry, called in and examined.

Chairman

378. Dr Coleman, we are very grateful to you and your colleague for coming here and giving us evidence at this stage this afternoon. We are also very grateful to you for your written evidence which was very clear and helpful. If you would like to make any amplification we would be delighted to hear it.

(*Dr Coleman*) Good afternoon, my Lords. I am Ron Coleman, Chief Engineer and Scientist, from the DTI. On my right is Mr Robert Foster, the person in the DTI most concerned with international R&D activities. I would like to say a few words by way of introduction. First of all, we welcome this opportunity to come and talk to you because it is an important subject and although we are mainly concerned with technology and industry and your emphasis is on science nevertheless, I think you are drifting into technology as well. There are a wide range of activities in the DTI of an international nature with programmes such as the Framework Programme and EUREKA and more specialised areas such as space through the European Space Agency, ESA, and metrology through EUROMET. We get down to helping individual companies and individual scientists and industrialists who collaborate overseas as well. One guiding practice within the Department is trying to link together international and national programmes. We do not just consider the international programmes alone, we have thought out fully beforehand, taking into account guidelines which come from the Cabinet Office, the relationship between national and international programmes so at any particular time we can decide quickly whether that programme fits in adequately with what we are trying to do in general. I would also like to say in the DTI we have been very proactive in this area, for example although EUREKA was the idea of President Mitterand in fact the realisation of that idea was essentially due to the UK and because of our efforts it became what we call a bottom-up programme with the emphasis on the programmes coming from the industry itself. In the case of the Framework III Programme we were very active in the half of the

programme concerned with industry, helping define the Programme and, indeed, we drafted—Robert Foster drafted—very significant parts of the detail in it. We have also been making initiatives on our own in the area of EUROMET, bringing together European metrology laboratories for the benefit of all countries. We have done the same thing in the area of EUROCHEM which is concerned with the testing laboratories for chemical measurements which is an important area and we are playing a significant part in it.

379. Thank you very much. I think if we can start off by concentrating on the European Framework Programme because a great deal of the evidence we have received has revolved around that and you are the lead Department. There have been a great many complaints about that in some ways. Are you satisfied the European Framework Programme in fact fulfils the purpose for which it was designed? Do you manage to get as much influence as you can expect into the drawing up of the Programme itself, and then having done that are you happy with the extent to which scientists and industrialists and others in this country can benefit from the Programme? Finally, would you like to comment on the frequent accusation that, far from this leading to additional science or technology of national programmes, because of the way the Treasury work the attribution and the rest of it, in fact it means quite a large slice of money that would otherwise go into the progress of national programmes is taken off them?

(*Dr Coleman*) May I make a few comments and then pass you to Robert Foster because he has been more concerned with this than anyone in the DTI. The short answer is we are happy with the Programme. We have put a lot of effort in to make sure it does complement what we are doing nationally and many of the criticisms are unjustified. Perhaps Mr Foster would like to amplify our involvement in the design of the Framework Programme.

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[Continued

[Chairman *Contd*]

(*Mr Foster*) If I could reverse the first two questions and answer how we influenced the design. In practice what tends to happen is the European Commission initially initiate the first proposals for the technical goals and objectives for a programme. That is what happened on the Framework III Programme. We and other Member States looked at this and said: "it is entirely unsatisfactory, we must go back and restart again in order to give better goals and objectives". In the case of industry programmes the DTI taking the lead from the Cabinet Office, did a complete redraft of the industrial goals and objectives in order to make sure they were not related to the development of products but were related to the development of prenormative standards which we consider a major focus on industrial programmes. Now, if you look at the industrial parts of the technical Framework Programme you will see a lot of that wording, particularly in the introduction and in specific parts like those on the Information Technology and Communications Programmes, is definitely geared to standards and renormative activities which we believe is what a major part of a Strategic Competitive Programme should be. Hence to answer your second question overall, we believe the Department has been able to have a very influential role in the shaping of the objectives of the current Programme. Can I go on to the first question, as to fulfilling the intentions for which it is designed. Much of the rationale as seen by the Commission has been to increase industrial competitiveness and one of the difficulties here is how you prove that is happening. We can quite clearly see this through the past strategic research programmes; for example in information technology there has been a great deal done on the development of open systems, which is the means by which equipment from different manufacturers and people work together when operated by users, which increases user competitiveness and efficiency throughout Europe. How you put an economic figure on that is a much more difficult to do. In broad terms as regards increasing user efficiency through strategic programmes there has been an improvement. But it is very hard to put any detailed quantitative benefit figures on it. If you ask the question have products come out of the European Framework Programme, again I think these are ten year plus programmes, i.e. long term programmes, and we would not expect to see that many product areas coming out yet, if one looks at areas such as information technology, for example software support environments are coming out but it will take some years before they start being widely applied by users. I have to emphasise the very long term nature of some of these programmes. One can see from the evaluation being done that good progress is being made towards products but one cannot point to great swathes of these in the market at the moment. To judge the extent that industries can benefit, one has to look at the quality of collaboration. There are a great many major companies involved, though not many small and medium sized companies but the Commission is

making efforts to increase that. If we look overall at the industry programmes where our return is about 20% of the total costs involved, we are getting out of the programmes overall as much as we put in.

So in our view it is a success in terms of the United Kingdom's industrial participation. Whether that will actually lead into products is something we will have to see over the next ten years. At this stage we are getting our *juste retour* and that must be one sign that there is a very strong United Kingdom industrial interest and participation. On the question of whether national programmes are affected in terms of overall size in relation to the size of European programmes, you heard the evidence from the Treasury on that. Clearly to some extent there is a relationship between increases in the amount spent on European programmes and some reduction in national programmes. There is that relationship. However, at this stage when we actually look at the position, we could not say in the case of industry programmes there has been any significant cutback in national programmes at this stage. However, in the course of the normal bilateral negotiations with the Treasury we have the capability to negotiate increases if we think they are justified because, to some extent, there must be a mismatch between the priorities the Department would like to see in the European programmes and what actually happens. In order to try to meet that mismatch clearly we will negotiate, and will negotiate toughly, with the Treasury in order to get flexibility in future allocations that come to the Department. But at this stage we are not conscious yet of any major impact on national programmes. But one has to say the European Framework Programmes are increasing in size and that therefore in due course that some effect inevitably will arise.

380. You said the projects come straight from the Commission first, then you argue about whether they are suitable or not.

(*Mr Foster*) Could I clarify that?

381. Do you have any influence in, as it were, the formulation before it comes to the stage of being a formal proposal by the Commission?

(*Mr Foster*) I am sorry, I did not make myself clear. What I was talking about at that stage was not individual programmes. I was talking about the definition of the technical content of the 1990-1994 Framework Programme 3. If we actually talk about specific projects within that, then if we take information technology or the telecommunications programme, we look at the detailed proposals which have been developed by the Commission and there is a very close dialogue which has been going on through two sources. One is direct contact between the Department and DG 13 and DG 12 officials in order to shape that programme; that is the first way. There is also feedback to the Commission through what is called the CREST mechanism, which is the co-ordinating group across the European Community in which the Cabinet Office take the lead, on which we regularly brief about once every three

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[Continued

[Chairman *Contd*]

weeks on the specific points that we want taken up in relation to the individual programmes, whether information technology, industrial technology or the RACE programme. Of course, thirdly we encourage industry and representational groups to talk directly to the Commission in order to find out what projects are coming up and to influence them. All these three processes are going on and going on actively.

382. Some evidence has come to us that industry complained that they do not get to hear about a project in which they might be interested until a very late stage, that they do not, through you or any other source, get warned that one of these projects within the programme is likely to come up, so that they can begin to become interested in it and come to advise you as to whether it is a good thing or not; not until the programme is finalised by the Commission do they ever hear about it at all. Is that the case?

(*Mr Foster*) I think that is inevitable if one looks at some of the larger projects which are being proposed and worked on within the Commission. The Commission does make great efforts to keep these under wraps because to some extent they know they are going to be lobbied from so many different sources and it is very hard to please everyone. However, those companies that want actively to find out what is happening are in contact with the relevant technology divisions in the DTI or directly with DG12 and DG13, and in many cases I believe they are told about the nature of the projects that are being developed because the Commission itself knows that it needs to define projects in a way which is broadly going to be of value in Europe.

Lord Shackleton

383. Do they actually talk to DG12 or DG13? Are they people who have previous experience? Would industry know it is worth talking to DG13?

(*Dr Coleman*) I am sure that they do know. We know on the basis of past experience that if you are constantly in contact with officials in DG12 and DG13 you can have a profound influence on the overall shape of the programme and on the detail of the programme, and it is important to be constantly in touch with them. We tell this to companies and we also have our own advisory groups where we share this information and in that way it also gets out to industry. In addition, when programmes are clear we quite often hold what one might call "town meetings" in which you invite anybody who wants to come and tell them "Here's the programme, these are the details and this is the date by which your programmes have to be in", and usually that is several months. So I do not think it is reasonable to say there is not adequate time for industry to respond.

Baroness Nicol

384. Are you satisfied that the scheme that is being operated is the best that can be devised or have you ideas for improving it?

(*Dr Coleman*) One can always improve things. It would be naive to suggest that you could not. But we are now on the Third Framework Programme and we have learned a lot from the previous two. We are getting better. As I say, the main way is by keeping close contact and, as things develop, making sure this information gets out through trade associations, research groups and the companies themselves. I do not think you can actually do very much more.

(*Mr Foster*) One rider, if I may add, is that I think that one has to have very strong management committees in the European Commission who are advising on each of the programmes. We, and in particular the Germans, have been pressing the Commission extremely hard. It was an issue raised by the External Review Board of industrialists in the lead into Framework Programme III that industry and Member States should be more in the driving seat in defining the programmes and it should not be left entirely to the Commission. The key way of doing that is to have management committees which have clout. Admittedly these are management committees which have civil servants from all over the Community on them, but if we can get the right structure for the management committees on which there is a great deal of political effort going on at the moment, then it will put Member States in a stronger position to have a more balanced relationship with the Commission, particularly in the formulation of major programmes.

Lord Lewis of Newnham

385. When you say you are in communication with industry, is that at a stage where the decision has been taken as to what is in the actual programme, or at a stage when you can alter the programme in some way or other? As a supplementary question, in your report you use the phrase that the Commission, when preparing the Programme proposals, "also consults widely with European industry". I am not quite clear how the Commission goes about it. Is that through the DTI or do they directly go to industry, or is it a combination?

(*Dr Coleman*) It is both. Answering your first question first, we do consult with industry in the formulation of the programmes so that we can try and make sure that the international aspects dovetail with the national programmes. After the event also we consult with industry so that they can respond to the proposals. When it says in the memorandum that the Commission consults, it does that as well and it has typically bodies like the European Federation of R & D Managers and organisations such as that which it regularly consults to help it in the formulation and definition of programmes. So there is a lot of consultation going on.

Lord Kirkwood

386. Partly Lord Lewis has asked the question I wanted to ask, but I wonder whether one of the aims should not be wider consultation? For instance, I happen to be a grant holder in one of the

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[Continued]

[Lord Kirkwood *Contd*]

BRITE-EURAM projects. There is no reason I should be particularly consulted but I am not aware any of my academic colleagues have been consulted on the formulation of the broad outlines of the Framework Programme, and I am not aware my own university was consulted. There is certainly a large group of people very much involved with using the scheme that has not been involved in establishing the broad framework. Is there not an area here that requires improvement?

(*Dr Coleman*) This could be improved. Let me tell you how we do consult. We do have committees in the areas you are talking about, in the areas of information technology and biotechnology, advising both DTI and the Science and Engineering Research Council which look at the national programmes on both the industrial and academic sides. We use those advisory bodies to help us in commenting upon that Framework Programme. There is that kind of consultation involving both academics and industry.

Chairman

387. When you are considering the main Framework and coming to decisions about how the Minister is going to be briefed for a meeting to discuss the main Framework, and also other European programmes with which you are directly involved, not just the Framework, at what level are those discussed? Are the chief scientists of the Department concerned meeting together, or is it at a lower level? Is it the scientists involved or the civil servants? What is the level at which the decisions are taken?

(*Dr Coleman*) There is consultation at all those levels. If I can come back to the preliminary discussions on the Framework III Programme, six or eight months before it was settled there was a discussion amongst the chief scientists when we were starting to see the shape of the Programme, and I can remember on that occasion some departments saying: "Well, we are not too sure whether this is in our best interests. How can we change it?" and I said: "Go to Brussels. Go and talk to them and if you know what you want you will have a much better chance of getting it if you can tell them that we are coordinating advice of that kind at that level". Then as time went on there was co-ordination between the Cabinet Office and people like Robert Foster, the Department of Education and Science, at that level. There was also further discussions between the officials and advisory committee which involved representatives from the industrial and academic institutions.

(*Mr Foster*) Could I flesh that out a little more. Certainly there was advice from the industrial and academic centres on the overall Framework, for example we had advice from ACOST and advice from the CBI. If we talk about BRITE-EURAM, the DTI is in contact and speaking directly to an advisory committee it has set up with technologists about BRITE-EURAM. We have run two seminars on BRITE-EURAM to get feedback from people

who come along from the industry. I am sure you are right, there is scope for improving and widening the consultation but there is consultation going on.

Lord Kirkwood

388. These are open seminars or invited ones?
(*Mr Foster*) Yes.

389. Invited?

(*Dr Coleman*) The seminars are open to anybody. One sends out mailshots inviting people but if anyone is not invited they can still come.

390. I have seen seminars advertised once the Framework is established on how to submit proposals to the EC programme but I have not seen invitations to seminars for discussing the Framework itself.

(*Mr Foster*) Officials from the manufacturing technology division, and one in particular, are organising these seminars to tell industry about the developments taking place, he is, in fact, the individual responsible for the negotiations on the Commissions management committee and also for briefing the CREST activity on what our line should be and is picking up a great deal of information from industry. We are talking to industry on progress at all of the seminars.

Lord Taylor of Blackburn

391. What about small organisations and small firms?

(*Dr Coleman*) We do our best to encourage small firms to come along. We use our regional organisations. We have got vast amounts of literature which are available but I think you have also to remember maybe it is not always appropriate for most small and medium sized companies to be involved in co-operative research which will have a payoff ten years from now. Quite often their interests are in shorter term developments. One has to be careful about diverting them from their major requirements.

Chairman

392. Could you compare this with EUREKA? It seems to me you are concerned with three very different programmes in the European field. There is the European Space Agency. EUREKA is handled in a very different way from the Framework Programme and again they are both handled in a very different way from the ESA programme. Would you like to comment on the advantages and disadvantages and say something about how successful you think EUREKA is and whether it is fulfilling its purpose?

(*Dr Coleman*) I would say there is a fundamental difference. The programmes under EUREKA come from suggestions from industry, there is nobody at the top saying: "We should go into this area or that area", it comes up from the bottom and that was a

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[Continued

[Chairman Contd]

deliberate style which was introduced at the beginning. The other important difference between EUREKA and the Framework Programme is that EUREKA tends to be nearer to the market place, not necessarily so but very often that is the case. There is a secretariat in Brussels. It just happens to be in Brussels. It is not directly connected with the European Commission, which is relatively modest in size. It tries to disseminate information coming from the companies through their representatives from the Member States to the central secretariat which is then disseminated widely through all of the European countries, so you know what programme is being formulated. Again, this is a relatively light touch as compared with the Framework Programme. That is a very significant difference in style and I think appropriate for the industrial based programmes.

393. What part do you see your Department playing in EUREKA?

(Dr Coleman) Our major role is, first of all, spreading the message that EUREKA programmes do exist and it is worthwhile encouraging cross-border collaboration. Then we act as the interface between the industrial proposals and the central secretariat who then pass on this information to other Member States. Also one must accept that the companies themselves will often go directly at an early stage to other companies in other countries to see whether or not they are interested in joining in the collaboration.

394. Do you think there is any lesson to be learned from it or are they so different it is not worth trying to compare them? Is there any lesson to be learned from the way in which ESA operates? That is to say, there is an obligatory core and then a programme which you can either take part in or not; with the European Framework Programme in which the sum of money is fixed, you then just have to see what best can be got out of it.

(Dr Coleman) In the case of EUREKA —

395. I am not talking about EUREKA, I am trying to compare the funding of ESA with the funding of the Framework Programme.

(Dr Coleman) The Framework Programme is all obligatory, if you like.

396. Do you think it should be or do you think it should be more like ESA? Would that be practical?

(Dr Coleman) We do have another mechanism of co-ordination from the Commission called COST, which is a variable geometry programme rather like the ESA ones which are optional.

397. So it is rather like the optional programmes of ESA?

(Dr Coleman) Yes.

Lord Sherfield

398. Could I follow up this business about COST? You give an account of it at paragraph 15 of your memorandum. It is not quite clear to me exactly what sort of programmes actually come in under this heading. Perhaps you could give one or two examples. Then turning to your financial annex A there is no reference to COST but there is a reference to COST in the annex to the evidence from the Department of Education and Science. So I am not quite clear how it is paid for, whether you in fact make any contribution to the COST programme or whether it is done from the Department of Education and Science, or how.

(Dr Coleman) We do make a contribution. I think Robert will explain what goes on.

(Mr Foster) If I might, the Cabinet Office is in fact in the lead on COST. COST is more geared towards interchange of information and so forth within the public sector and research organisations. We believe it has been very effective and has over the years proved itself and in many cases led to important collaborative R & D activities in which industry has been involved. Having said that, in general when it comes to a specific project or programme, a European R & D or EUREKA project is usually more appropriate if a company is starting from scratch. Hence, when a company wants to get involved in a European programme or project, there tend to be more appropriate ways for companies to become involved with European collaboration than COST. However, under COST, if there is a specific project which has emerged through this process of information interchange, then the Department may fund under the normal rules of additionality and there are quite a number of projects in which the DTI has been involved in funding. In general when talking to companies who want to collaborate on European collaboration we will tend either to encourage them to go down the route of a Commission run programme or alternatively to suggest that they may like to define a project under EUREKA.

399. The allocation in DES is one million I think, but you have not got in your annex any figure for it. Is it really a rather small business?

(Mr Foster) A relatively low contribution. Our major contributions are overwhelmingly in European collaboration through ECR and the R & D framework, EUREKA, which is growing, but the COST activity is very small.

400. Is it effective? Do you prefer to encourage it?

(Mr Foster) I think in some areas.

401. Are you actually producing results?

(Mr Foster) For example, in telecommunications it has been found to be useful but in general, as I was saying, we would encourage potential collaborators in Europe to go for either a EUREKA or European Community programme rather than COST. But

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[Continued

[Lord Sheffield *Contd*]

there are instances where people whose prime interest is in interchange of information—maybe in the academic sector or people who want to find out what is going on—and if there is a COST programme, of course, we would then point them in that direction.

Lord Kirkwood

402. Is it not also a rather more flexible model with less bureaucracy? Are there not those advantages in funding or running such European research programmes through that model rather than through, let us say, the framework model?

(*Mr Foster*) I think that is true vis-a-vis Framework Programme, though vis-a-vis EUREKA there is a rather comparable position. EUREKA has a very small secretariat and is in practice very much a bottom-up exercise.

Chairman

403. Could we lift our eyes from Europe a moment and look wider afield? Certainly on a number of occasions it has been said to us that we do not collaborate enough with Japan. On the other hand, the accusation has been made also that we do not collaborate enough with the United States. It is true to say we do not have a bilateral scientific exchange agreement with Japan, do we? Do you think this is a failure? We have heard various criticisms of attempts to collaborate both with America and Japan which turned out to be negative. Do you think this concentration on European programmes, which has at the back of it the idea of competing with Japan and America, is prejudicing scientific and technological co-operation with Japan or America or anybody else?

(*Dr Coleman*) I would start by saying there is an obvious reason for collaborating within Europe and that is geographical. It is much easier to collaborate with people who are a few hundred miles away rather than a few thousand miles away. If you consider collaboration with the United States, then the answer I would give is that it is difficult. They are not used to collaborating. They are a wealthy country—or until recently they have been—so wealthy that they did not have to worry about collaboration. If they wanted to do it, they did it. It is only in relatively recent times that they have had many very large projects which they cannot afford themselves and they have sought collaborators, and they have yet to learn, in my view, how to do it in a way which is going to encourage people to collaborate with them. When one turns to —

404. You are talking about American industry?

(*Dr Coleman*) American industry or American government, for that matter. I have been to the United States and tried to discuss with them some of their large programmes and say “Clearly you can’t do them all, will you prioritise them? Then we can see which ones we could help you with”, and you do not actually get sensible answers. When one

considers Japan, I think it is quite a different story. Japan realises that traditionally it has been weak in basic science and is certainly now looking for collaboration in those areas and encouraging individual academics and organisations to collaborate with them. I think it is for those organisations to decide if they wish to do so. I do not think we would benefit by having a formal agreement with Japan but I would like to mention to you some things that we are doing to help people find out more about Japan. Within DTI we have been running missions to Japan in which groups of companies come together to send people to Japan, helped by DTI and the Embassy in Japan to visit a fair number of companies to find out about the technology available and see whether there are opportunities for collaboration. Only in May of this year I led a mission of senior industrialists to Japan in the field of advanced materials to look at their view of the markets, their view of technology and opportunities for collaboration. All seven companies that came with me (and we reported back widely through seminars) were very enthusiastic. Between us, DTI and the Embassy we opened doors that they could not have got through themselves and we are going to repeat this exercise two or three times in 1991.

405. So you think there is a field for greater co-operation?

(*Dr Coleman*) Definitely.

Lord Shackleton

406. Is that significantly different from the missions that go on all the time to different countries, many of them led by ministers, and various trade councils?

(*Dr Coleman*) I think there is a similarity and a difference with a straightforward trade mission since we certainly take into account how they see developments in technology. We are not looking just solely for the straight sale of products in the short-term, we are looking at their strategic view of future markets and how we might collaborate with them either in research or products or distribution. It is quite a wide range. They were surprisingly open during the recent mission and the companies said they would not have got that information in anything like that timescale.

Lord Sheffield

407. Some of us went to Japan about three years ago and in talking around we got really a co-ordinated answer that: “Oh, yes, collaboration with the United Kingdom is desirable but it is very difficult in the absence of one of these Government to Government agreements”. It was perfectly clear that was a message which had been conveyed to us by collaborative inner workings of the Japanese government. When we came back we recommended in our report that such an agreement should be negotiated in view of the very clear evidence we had

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DR R COLEMAN and MR R FOSTER

[Continued

[Lord Sherfield *Contd*]

got that it would assist in discussing scientific and technical matters between the two countries. That recommendation was not accepted on grounds which frankly I did not find very convincing. Now, has the situation changed since then? Are you saying you are getting the proper sort of response from the Japanese without an agreement?

(*Dr Coleman*) Yes. I would say we are getting a good response. Our experience generally speaking is that formal agreements do not make very much difference one way or the other except they take resources and services. You have had to agree in the past with what we will call the Eastern European countries otherwise you could not have done anything. But you spend more time worrying about agreements than actually bringing about collaboration. I feel the relationships we have forged with the Japanese now would not be improved by having a formal agreement.

(*Mr Foster*) Having said that I think Japanese industry does have a very close dialogue with its government, particularly with MITI, and the talks that the DTI has with MITI are informally followed up a number of times during the year. I was in Japan last month for follow up with MITI and we are talking with MITI next week. MITI are helpful in opening doors and one of the things we have been discussing during the talks is the extent to which they can open doors for these high level missions which Dr Coleman has just described. That type of informal inter-Government relationship is very

important. The Japanese have not been pressing us recently for a bilateral science and technology agreement you mentioned. We are very anxious to see the informal links with Japan, such as DTI-MITI talks, properly made use.

Chairman

408. From what you have said I think you would disagree with the criticism the Royal Society made to us that there is a vacuum in the Government machinery in handling these scientific projects and there is a need for improvements in one of the existing bodies, whether the Science and Technology Secretariat in the Cabinet Office or ABRC, whoever it may be, particularly when it comes to decisions about whether or not to participate in the proposal from the outset. You reckon it works satisfactorily?

(*Dr Coleman*) If the comment came from the Royal Society I suspect it was mainly to do with scientific projects. My main area is technology projects. I think that is perhaps the difference you would like to air with them.

409. You are happy on your side, are you?

(*Dr Coleman*) As Mr Foster said we do have these regular meetings with MITI. They are not part of an agreement but it does make sure we meet each other on a frequent basis and follow up the actions we have said we are going to do.

Chairman] Thank you very much, Dr Coleman, Mr Foster.

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Memorandum by the Department of Education and Science

INTRODUCTION

1. UK scientists, and scientific institutions, are engaged in many forms of international collaboration both within Europe and more widely. Besides the science programmes of the European Community, other collaborative activities include those based on usage of large facilities (CERN, IL, ESRF)¹; other pan-European organisations (ESA, ESF, COST, EMBC, EMBL)¹; and a wide range of smaller scale bilateral and multilateral programmes, directed towards research, training and information exchange. Outside the specifically European context, collaboration may be at world level (WOCE, JGOFS); involve partners from many continents (HFSP) or bring together widely spaced bilateral collaborations (Anglo/Australian telescope).

POLICY BACKGROUND

2. Within the very broad spectrum of science in Government, the Secretary of State for Education and Science has responsibility, principally through the Research Councils, UFC and PCFC, for support of the UK's basic and strategic science capability.

3. The UK's general policy towards international collaboration in the field of science is to support research which meets one or more of the following criteria:

- is not already under way domestically or through other international channels; and where the benefit from collaboration will exceed the unavoidable extra costs involved;
- is complementary to existing national and international activities;
- improves the quality of science, including scientific manpower capabilities, and which offers scope for technology transfer;
- is aimed at improving industrial competitiveness or tackling trans-border issues, for example, health, environmental protection, or economic problems;
- involves large scale investment with sharing of costs and risks.

EUROPEAN COMMUNITY SCIENCE

4. Within Europe, programmes operated under the auspices of the European Community represent an increasingly significant proportion of UK collaborative effort. EC science and technology activities are now grouped within the Framework Programmes. Framework Programme II is currently running (1987-91). The new Framework Programme III will overlap this (1990-94) with a mid-term review in 1992. The intention is that the Framework Programmes should operate on a rolling basis thereafter to promote continuity. The December 1989 meeting of the Research Council reached agreement on a budgetary ceiling of 5.7 billion ECU for Framework Programme III. Discussion on the detailed content of the 15 individual programmes, for which Commission draft proposals have been issued, is now under way.

ARRANGEMENTS FOR EC SCIENCE WITHIN GOVERNMENT

5. The EC's Framework Programme covers areas within the responsibility of a wide range of Government Departments. The Secretary of State for Trade and Industry has the lead for the UK, and the Minister for Industry and Enterprise attends the Community's Research Council. Support for him in this capacity, and a co-ordinating role on international S&T generally at official level within Government, is exercised by the Science and Technology Secretariat of the Cabinet Office, under the oversight of the Chief Scientific Adviser. S&T Secretariat officials attend meetings of the Scientific and Technical Research Committee (CREST) in Brussels. Separate Committees within Government bring together Ministers and officials to review issues concerning international science on a regular basis.

6. Individual Departments within Government take a leading policy responsibility under the Framework Programme for separate Programme lines. This may be either by themselves or in conjunction with other Departments, depending on the content of the Programme. The lead Department will be responsible for preparations within the UK for, and attendance at, relevant official level meetings in Brussels; and for publicity within the UK for EC programme opportunities. In the case of the DES, these responsibilities are discharged in close consultation with relevant Research Councils. Programmes where the DES has the lead responsibility under both Framework Programmes II and III are listed at Annex A.

¹ glossary of acronyms attached.

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[Continued

UK FUNDING ARRANGEMENTS FOR EC SCIENCE

7. The UK's contribution to R&D expenditure which is financed through the Community budget comes from the same pool of resources, and represents the same burden on domestic taxpayers, as does direct funding of R&D by Government Departments. Much the same public expenditure controls are therefore applied.

8. Responsibility for Community expenditure on R&D is shared by a number of Departments. Provision for such expenditure has been allocated to each of them. If expenditure exceeds, or is expected to exceed, planned levels, Departments' domestic public expenditure baselines are correspondingly reduced at the beginning of each year's Survey. Departments can bid for re-instatement of some or all of these reductions and such bids are considered alongside all other claims for increased spending in the annual public expenditure round.

9. This approach is designed to secure:

- i. that Departments adopt the same rigorous approach to value for money in terms of Community expenditure as they do for domestic expenditure;
- ii. that inevitably finite resources are allocated in line with relative priorities; and
- iii. that expenditure from the Community budget is treated on the same footing as any other form of public spending.

SCIENTIFIC COLLABORATIVE PROGRAMMES—OUTSIDE THE EC AND BEYOND EUROPE

10. The UK is an active participant in many collaborations outside the European Community. Different financial, membership and other terms of participation apply to each. In general the Government welcomes and seeks to foster a diversity of scientific organisations within Europe, including those—for example the European Science Foundation—which seek to draw together national research agencies for the promotion of mutually beneficial scientific exchange and development.

11. Annex B lists the largest international collaborations involving the UK determined by size of budgetary input. Further information about these will be supplied if the Committee wishes.

12. Collaborative programmes operated on a basis *wider* than Europe do not, of themselves, raise evidently separate issues. Logistic factors such as travel obviously play a relatively larger part in judging the case for a particular collaboration. Different styles of scientific administration can also be a complicating factor (for example US representation in the Human Frontier Science Program is shared between the National Science Foundation and the National Institute of Health; three Japanese Ministries/agencies are involved). Such factors place a premium on the quality of management structure within programmes both to ensure the maintenance of scientific quality and to secure effective and regular evaluation of the results achieved. The UK is customarily active in promoting sound and effective management arrangements in the interests of securing optimum value for the resources invested.

ISSUES FOR THE CURRENT ENQUIRY

13. The Department believes that the scope for developing particular forms of international collaboration in areas within its responsibility should normally emerge in the first instance from contact between scientists at working level. Once any particular collaboration is identified as scientifically desirable, a range of factors—some of them counterbalancing—will affect the way in which it should be carried forward (including any relevant questions of location). Scientifically speaking, it is frequently argued that substantial scientific advantage stems of itself from collaboration across national frontiers since this enables new and wider perspectives to be brought to bear on particular issues. Such advantage must naturally be counterbalanced by the greater cost and logistic factors involved—for example, overseas travel; use of foreign languages; time spent on meetings, etc.

14. Where the location of large facilities is concerned, judgments would include, on the one hand the additional cost and organisational requirements placed upon the hosting country, and on the other, the advantages presented by ease of access for UK scientists; the stimulus for them of proximity to a major scientific facility; the likelihood of the UK securing industrial contracts; and the cross-fertilisation stemming from a steady flow of scientific visitors from abroad. None of these factors is financially quantifiable in advance to any level of precision: decisions taken therefore represent a balance of judgment in relation to each opportunity. Discussions may involve, besides the originating scientists, the DES and other relevant Government departments, the Advisory Board for the Research Councils, and any other agencies affected. Decisions ratified at Government level will also require Ministerial agreement.

15. As indicated above, the development of particular collaborations will frequently involve judgments concerning factors not encountered in the domestic context. Payment of contributions in foreign currency will increase exposure to extraneous economic factors outside the control of the Science Budget holders in

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[Continued

question. Within international organisations, terms and conditions for staff are also likely to vary in relation to the various national domestic arrangements reflecting the features of employment in the collaboration concerned. The extensive and increasing range of collaborations with which UK scientists are involved does not, however, suggest that any particular aspect of difficulty is such as significantly to reduce or preclude collaborations where the scientific justification is seen as sufficiently strong and sufficient human and financial resources are available. The reality is that conditions vary so widely between potential collaborators in various countries around the world that the decision whether or not to proceed in particular cases can only be taken on the basis of a well-informed perception of conditions in the country concerned and experience of its previous track record in collaborations.

*Science Branch
Department of Education and Science
August 1990*

ACRONYMS FOR SCIENTIFIC ORGANISATIONS AND FACILITIES —referred to in DES memorandum

AAT	Anglo-Australian Telescope
AFRC	Agricultural and Food Research Council
ATSR	Along Track Scanning Radiometer
BOFS	Biogeochemical Ocean Flux Study
BRIDGE	Biotechnology Research in Innovations Development and Growth in Europe
CERN	European Organisation for Nuclear Research
COST	Co-operation in the field of scientific and technical research (participants: EC countries, EFTA, Turkey, and Yugoslavia)
CREST	Scientific & Technical Research Committee (of the EC)
EISCAT	European Incoherent Scatter Radar Facility
EMBC	European Molecular Biology Conference
EMBL	European Molecular Biology Laboratory
EMBO	European Molecular Biology Organisation
ERS	Earth Remote Sensing (Satellite)
ESA	European Space Agency
ESF	European Science Foundation
ESRC	Economic and Social Research Council
ESRF	European Synchrotron Radiation Facility
HFSP	Human Frontier Science Programme
IARC	International Agency for Research on Cancer
ILL	Institut Laue Langevin
ISO	Infra-red space observatory
JGOFS	Joint Global Ocean Flux Study
LEP	Large Electron-Positron Collider
MAST	Marine Science and Technology Programme
MRC	Medical Research Council
NERC	Natural Environment Research Council
ODP	Ocean Drilling Programme
ROSAT	Roentgen Satellite
SCIENCE	Stimulation of the International Co-operation and Interchange needed by European Research Scientists
SERC	Science and Engineering Research Council
SPES	European Stimulation Plan for Economic Science
WOCE	World Ocean Circulation Experiment

*DES Science Branch
August 1990*

ANNEX A

EC FRAMEWORK: PROGRAMME LINES WHERE DES HAS LEAD RESPONSIBILITY

A: SECOND FRAMEWORK (1987-91)

(i) *MAST* (Marine Science and Technology Programme)

Definition—Four-year programme (1989-92) to contribute to better knowledge of the marine environment; encourage the development of new technologies; improve co-ordination among national programmes; strengthen industrial competitiveness; assist development of common standards; assist European participation in world-wide ocean programmes; and facilitate training and exchange of personnel.

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[Continued]

Community funding—50 MECU over four years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of the Member States. UK representation one government administrator: one UK scientist.

Status—Programme adopted by the Council of Ministers on 20 June 1989. Commissioning of projects completed.

(ii) **SCIENCE** (Stimulation of the International Co-operation and Interchange needed by European Research Scientists)

Definition—Five-year programme (1988-92) consisting of a range of temporary financial support measures to assist the training and mobility of researchers, communication among scientists, and the development of scientific co-operation in the Community. The programme applies to multi-national projects in all fields relevant to the natural sciences.

Community funding—180 MECU over five years.

Programme Management—by the Commission assisted by CODEST.

Status—Programme adopted by the Council of Ministers on 29 June 1988 and a Guide for Applicants has been issued. Applications are invited at any time: awards are decided quarterly.

(iii) **SPES** (European Stimulation Plan for Economic Science)

Definition—Four-year programme (1989-92) to assist the mobility of economists, improve training in economic science, encourage young European economists to return to the Community and enhance communication among Community economists.

Community funding—10 MECU (raised in 1990 from six MECU) over four years.

Programme Management—by the Commission assisted by CODEST.

Status—Programme adopted by the Council in February 1989. Commissioning of projects still in process.

(iv) **LARGE FACILITIES** (Community Support Plan to Facilitate Access to Large Scale Scientific Facilities of European Interest).

Definition—Four year programme (1989-92) to maximise the use of large scientific and technical installations and facilities through an EC financial contribution to the cost of adapting, upgrading and operating them, in return for access being given by the institutions to European researchers.

Community funding—30 MECU over four years.

Programme Management—by the Commission assisted by CODEST and an advisory committee comprising representatives of the Member States.

Status—Programme adopted by the Council in March 1989. Commissioning of projects completed.

(v) **HUMAN GENOME ANALYSIS PROGRAMME**

Definition—Two year programme (1991-92) to use and improve new biotechnologies in the study of the human genome for a better understanding of the mechanisms of genetic function as well as the prevention and treatment of some human diseases by precompetitive Community research, setting up and reinforcing networks of European laboratories, and training.

Community funding—15 MECU over two years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of Member States.

Status—Programme adopted by Council in June 1990. Call for proposals issued/to be issued in September.

(vi) **MEDICAL AND HEALTH RESEARCH PROGRAMME**

Definition—a five year programme (1987-91) to co-ordinate work carried out in the individual Member States on the following themes:

Sub-Programme I: Major Health Problems

- i. Cancer
- ii. AIDS
- iii. Age-Related Health Problems
- iv. Environment and Life-Style Related Health Problems

Sub-Programme II:

- i. Medical Technology Development
- ii. Health Services Research

Community funding—65 MECU over five years.

Programme Management—by the Commission assisted by an advisory committee comprising representatives of Member States.

Status—Programme adopted by the Council in November 1987. Commissioning of projects completed.

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[Continued

B: DES LEAD RESPONSIBILITIES UNDER THE THIRD FRAMEWORK (1990-94)

In the six main programme lines, responsibilities are identified below at the sub-programme level, except in the case of B(iv) (Line 6), where there is no disaggregation.

*Line 3: Environment***(i) Mast (Marine Science and Technologies)**

Definition—to build upon the MAST pilot programme by special focus on relevant basic research (including oceanography); coastal engineering; and technologies for the exploration and exploitation of resources.

Community funding—estimated at 104 MECU over five years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

*Line 4: Life Sciences and Technologies***(ii) Biotechnology Programme**

Definition—a programme to reinforce basic biological knowledge as the common and integrated foundation needed for applications in agriculture, industry, health, nutrition and the environment. The goals of the current BRIDGE programme (Biotechnology for Innovation Development and Growth in Europe), whose aim is to strengthen technology transfer from research to industry, agriculture and medicine, will be expanded.

Community funding—estimated at 164 MECU over five years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

(iii) Biomedical and Health Programme

Definition—a programme to improve the effectiveness of R&D in medicine and health through better co-ordination between Member States, in terms of both the use of resources and the application of findings. The main focus will be on new approaches to tackling economically and socially significant diseases (in particular cancer, AIDS, heart disease and mental illness), ageing, the problems of the handicapped and workplace health. Activities will also cover the study of the human genome.

Community funding—estimated at 133 MECU over five years.

Status—Precise programme content under discussion between Member States and Commission. Council decision outstanding.

(iv) Line 6: Human Capital and Mobility Programme

Definition—a programme of mobility and training of European (mainly young) researchers through the provision of fellowships, research grants, and networks of centres of excellence.

Community funding—estimated at 518 MECU over five years.

Status—Precise programme content under discussion between Member States and Commission. Council decision to follow.

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ANNEX B

INTERNATIONAL COLLABORATION: UK CONTRIBUTIONS

This list shows the major scientific collaborations within the field of DES responsibility. For the European Space Agency, DTI is the lead Department. In COST, the Cabinet Office S&T Secretariat takes the lead.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
MRC			
¹ European Molecular Biology Laboratory	2.6	2.6	2.8
¹ European Molecular Biology Conference	0.6	0.6	0.6
¹ International Agency for Research on Cancer	0.5	0.6	0.7
² Tropical Medicine Research Board laboratories, the Gambia and Jamaica	2.7	2.8	3.0
NERC			
² Participation in World Ocean Circulation Experiment (MAFF also participates)	—	1.9	3.3
² Satellite Remote Sensing	0.1	0.2	0.2
² Biogeochemical Ocean Flux Study	2.7	1.7	1.5
² North Sea programme	1.3	0.9	0.7
¹ Ocean Drilling Programme	1.4	1.4	1.4
SERC			
¹ European Organisation for Nuclear Research (CERN)	48.9	52.9	45.8
² European Space Agency	25.7	24.5	27.2
(DTI contribution):	51.8	53.2	52.3
² Anglo-Australian telescope	1.3	1.4	1.4
² Institut Laue-Langevin	8.7	9.6	8.9
² European Incoherent Scatter Facility	0.4	0.5	0.5
¹ European Synchrotron Radiation Facility	3.8	5.6	5.2
² Roentgen Satellite (ROSAT)	0.2	0.1	0.1
² Along Track Scanning Radiometer	0.1	0.1	—
² Infra-red space observatory (instruments)	0.7	0.5	0.4
² Observatories on La Palma	1.0	1.0	1.0
² James Clarke Maxwell telescope	1.0	1.1	1.1
Other			
² European Science Foundation	0.2	0.3	0.3
European Co-operation in Scientific & Technical Research (COST) (note 3)	1.0	(1.0)	(1.0)

Source: Research Councils.

INTERNATIONAL COLLABORATION: UK CONTRIBUTIONS

This list shows the major scientific collaborations within the field of DES responsibility. For the European Space Agency, DTI is the lead Department. In COST, the Cabinet Office S&T Secretariat takes the lead.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ European Molecular Biology Laboratory	2.6	2.6	2.8
¹ European Molecular Biology Conference	0.6	0.6	0.6

The European Molecular Biology Organisation (EMBO, founded 1963) is a private self-governing body of about 700 scientists. In order to develop molecular biology worldwide, EMBO awards fellowships, and organises exchanges, courses and workshops. The funding countries interact through the European Molecular Biology Conference (EMBC, founded 1972) and all but Belgium, Iceland and Ireland help fund the European Molecular Biology Laboratory (EMBL, founded 1974) in Heidelberg. Other funding countries are Israel, EFTA states, and EC states except Portugal and Luxembourg.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ International Agency for Research on Cancer	0.5	0.6	0.7

The IARC was founded in 1965 in Lyons by the World Health Organisation, to promote international collaboration in cancer research. Its main interests are cancer aetiology and generating and disseminating cancer prevention information. It conducts research projects; educates and trains personnel; and collects and disseminates information. The budget (set for two-year periods) was about £15 million (US \$ 27.4 million) for January 1990 to December 1991. The other members are Australia, Belgium, Canada, FRG, Finland, France, Italy, Japan, the Netherlands, Norway, Sweden, the USA and the USSR.

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[Continued

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Tropical Medicine Research Board laboratories, the Gambia and Jamaica	2.7	2.8	3.0

The Jamaica laboratory, at the University of the West Indies, studies the clinical features and natural history of sickle cell disease and other problems of Caribbean interest. The laboratory in the Gambia works on problems of tropical diseases as found in the Gambia, and is co-operating with Senegal, France and Denmark on trials of a new measles vaccine for infants too young to benefit from current vaccines. The Laboratories also receive support from the IARC, ODA, WHO, Family Health International and the Rockefeller Foundation.

NERC

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Participation in World Ocean Circulation Experiment (MAFF also participates)	—	1.9	3.3

WOCE is a worldwide programme to measure and model the deep oceans to understand how ocean circulation changes and ameliorates earth's climate. Over five years (1990-95) the programme will gather data vital for global climate change modelling. NERC hosts the WOCE International Planning Office.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Satellite Remote Sensing	0.1	0.2	0.2

NERC has an interest in data gathered by satellite remote sensing by ESA's ERS-1 earth observation satellite, due for launch early in 1991. It will carry a comprehensive set of instruments, scanning the earth's surface at microwave thermal frequencies, and be able to operate regardless of cloud cover and the availability of sunlight. ERS-1 is the first of a series of ESA space platforms (ERS-2 is to follow) designed to provide timely and accurate environmental data through a regular and systematic coverage of the world's oceans and land areas. The UK has been involved since the ERS-1 programme began, helping to define programme requirements, supporting various research activities and supplying equipment.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Biogeochemical Ocean Flux Study	2.7	1.7	1.5

BOFS is the UK component of the international Joint Global Ocean Flux Study (JGOFS). BOFS involves 60 scientists and 14 laboratories in a 5-year study of exchanges between ocean and air, particularly of carbon. Ocean absorption of carbon helps counter the greenhouse effect.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² North Sea programme	1.3	0.9	0.7

This study involves UK oceanographers in NERC and higher education institutions with European scientists. It builds on theories of tidal mixing in shallow seas and current findings on polluted estuaries and how marine animals can indicate water quality. The aim is to produce models to predict water quality.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ Ocean Drilling Programme	1.4	1.4	1.4

A study of the processes that determine the geology and evolution of the oceanic lithosphere. International scientific drilling began in 1975. The other members are the USA, Canada, FRG, France, Japan, and a European consortium led by the ESF. NERC pays most of the UK's annual contribution of US\$2.5 million; the oil industry make up the rest.

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[Continued

SERC

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ European Organisation for Nuclear Research (CERN)	48.9	52.9	45.8

CERN aims to promote European collaboration in high energy particle physics and was founded in 1954. The 1989-90 UK contribution, based on relative GDP, was about 16 per cent of CERN's budget. CERN has 3,450 staff at 1-1-88 (due to fall to 2,950 by 1-1-96). Its principal facilities are: the Synchro-Cyclotron, the Proton Synchrotron, the Super Proton Synchrotron, and the Large Electron—Positron Collider (LEP) completed in 1989. Other full members are the EC and EFTA states (except Ireland, Luxembourg, Finland, Iceland).

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ European Space Agency	25.7	24.5	27.2
(DTI contribution:	51.8	53.2	52.3)

ESA aims to promote European co-operation in peaceful space research technology and applications. ESA was founded in 1975 by merging the European Space Research and Launcher Development Organisations, ESRO and ELDO. The UK contribution for 1989-90 was £87 million; about £25 million from SERC and the rest from the DTI. Other members are Austria, Belgium, Denmark, France, FRG, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland (Associates: Canada, Finland).

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Anglo-Australian telescope	1.3	1.4	1.4

The UK and Australian governments jointly fund this successful 150 inch optical Telescope at the Anglo-Australian Observatory, by far their biggest joint science project. The Observatory now includes SERC's Schmidt telescope, a merger which benefited the UK. The UK provides half the AAT Board.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Institut Laue-Langevin	8.7	9.6	8.9

The ILL, through its High Flux Beam Reactor and associated instruments, provides a central neutron facility for specialists from laboratories in the partner countries to carry out researchy in nuclear and fundamental physics, chemistry, biology, and materials science. The ILL Protocol was dated 1967 and ILL started operating in 1972. The UK contribution in 1989-90 was £8.7 million. Other members are France and FRG; Spain and Switzerland are Scientific members.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² European Incoherent Scatter Facility	0.4	0.5	0.5

The European Incoherent Scatter facility, established in 1981 and based in Sweden, provides for the observation and study of the upper atmosphere at high latitude—i.e., within the Arctic Circle. Members include Finland, France, FRG, Norway, Sweden and the UK.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
¹ European Synchrotron Radiation Facility	3.8	5.6	5.2

The ESRF aims to achieve a significant enlargement of the range of experiments possible through existing synchrotron radiation sources by means of significantly enhanced brilliance and extended energy range. It was launched in 1988, with phase one to be completed in 1994. The principal facility is a high energy (6 GeV) electric storage ring source of high intensity X-rays. Other members are Belgium, France, Italy, Spain, Switzerland, FRG, and NORDSYNCR (Denmark, Finland, Norway, Sweden).

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[Continued

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Roentgen Satellite (ROSAT)	0.2	0.1	0.1

ROSAT is a collaboration between the FRG, UK and USA to launch (in May 1990, from NASA) a satellite with two X-ray cameras on board, to observe objects in outer space, using the soft X-ray and XUV bands. Total cost, including launch and cameras, is £200 million. The UK contribution is £18 million. (US £62 million, FRG £120 million).

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Along Track Scanning Radiometer	0.1	0.1	—

The ATSR is to fly on ESA's ERS-1 earth observation satellite. It is designed to measure sea surface temperature from space to an accuracy of a few tenths of a degree Celsius. Such measurements together with other data from ERS-1 will enable the scientific community to understand better the complex interactions between ocean and atmosphere.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Infra-red space observatory (instruments)	0.7	0.5	0.4

The ISO is the major infra-red observatory of the 1990s, scheduled for launch in 1993. The UK has a leading role in one of the instruments and significant involvement in two others. Although the recent Ariane failure did not involve ESA or UK directly, it is possible that scientific missions such as ISO, due for launch by Ariane-space, may be delayed.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² Observations on La Palma (note 3)	1.0	1.0	1.0

The Isaac Newton group of telescopes in La Palma provides the major Northern Hemisphere optical astronomy data for the UK. It is jointly funded by the UK and the Netherlands in the ratio 4:1. The Royal Greenwich Observatory has charge of their operation. The 4.2 million William Herschel telescope, the 1 million Jacobus Kapteyn telescope, and the 2.5 million Isaac Newton telescope were built between 1973 and 1983 at a total cost of £35.6 million (1989-90 prices).

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² James Clark Maxwell telescope (note 3)	1.0	1.1	1.1

The 15m telescope on Hawaii provides the major Southern Hemisphere optical astronomy data for the UK. The telescope permits new areas of study in the relatively unexplored sub-millimetre region of the spectrum. Responsibility for its operation rests with the Royal Observatory, Edinburgh. The telescope, funded by the UK, Canada and the Netherlands in the ratio 55:25:20, was constructed between 1980 and 1988 at a total cost of £12.2 million (1989-90 prices).

OTHER

	1989-90 £ million	1990-91 £ million	1991-92 £ million
² European Science Foundation	0.2	0.3	0.3

A non-governmental body of academies and research councils with national responsibility for scientific research, founded in 1974. UK members are the five Research Councils, British Academy and Royal Society. ESF is a centre of communication between members and individual scientists, seeking areas for European research co-operation, to promote the mobility of researchers and to provide initial stimulus for setting up collaborative programmes. There are 49 members from 18 countries.

	1989-90 £ million	1990-91 £ million	1991-92 £ million
European co-operation in Scientific & Technical Research (COST) (note 3)	1.0	(1.0)	(1.0)

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[Continued

An informal organisation set up in 1971, providing flexible arrangements to facilitate scientific and technical co-operation among Government organisations, institutes, universities and firms in different countries. Participating countries are the EC states plus Austria, Finland, Norway, Sweden, Switzerland, Turkey and Yugoslavia. COST allows for either co-ordination of national research or participation of non-member countries in EC programmes. Generally co-operation takes the form of basic research or activities of public utility.

Notes

1. List includes research programmes and subscriptions with payments over £01.m per annum, and excludes awards (fellowships, etc.).
2. Symbols: ¹DES signatory; ²Research Council signatory.
3. UK subscription paid by Cabinet Office S & T Secretariat. Participation in research programmes financed by industry, individual Departments and Research Councils.
4. All figures are in cash terms.

*DES Science Branch
July 1990*

Examination of Witnesses

MR R P RITZEMA, Head of Division A, Science Branch, International Scientific Collaboration, and MR K ROOT, Head of Division C, Science Branch, Management and Finance—Science Budget, Department of Education and Science, called in and examined.

Chairman

410. You have had the advantage, Mr Ritzema, of listening to the questions we have put to the DTI. We are very grateful to you and Mr Root for coming and giving your evidence to us this afternoon, and also for your paper which was very helpful. Your field is rather a different field from the DTI. I think perhaps, unless you would like to make some preliminary statement, I would be interested for you to comment on whether you see the European Framework Programme in the same light as you heard the DTI say?

(*Mr Ritzema*) My Lord Chairman, I would be very happy to do that. I wanted to make a brief set of introductory remarks and then perhaps we could go on to the European Community questions. I would like briefly to introduce myself and my colleague and explain our responsibilities within the Department of Education and Science. I head Division A within the Department's Science Branch, which includes among its responsibilities issues arising for Government in the context of international science, both European and on a wider basis. I have a small supporting staff who assist me with this work. Dr Keith Root heads Division C within the Branch, which includes among its responsibilities involvement with environmental science matters, including international environmental science collaborations. Mr Root's Division also covers financial questions concerning the Science Budget. The Branch itself is small and policy orientated, serving the needs of our Ministers and promoting their policy objectives. Activity is carried on in close co-ordination with the Research Councils and other science interests funded through the Science Budget. Our Branch is involved in some, rather than many, international science programmes, those where a dimension for Government exists. Circumstances vary but generally speaking this is where there is a need for discussions or negotiations at Governmental level; where Ministers are involved either as treaty signatories or through exchanges with

Ministerial counterparts in other countries; or where the Department must exercise its lead responsibilities in relation to particular European Community programmes. In relation to all these areas of activity we work closely with our scientific advisers and experts. Those are the only introductory remarks I would like to make. I would be happy to move on to your introductory question.

411. Can you say if you have any different view from that of the DTI about the European Framework Programme, whether you are concerned about the growth in the Framework Programme, whether Treasury rules about attribution are going to have a serious effect on the science budget, before we look at other programmes and any comments you have about whether the machinery both in this country and in Brussels is working satisfactorily in producing the answers for programmes you are concerned with.

(*Mr Ritzema*) Well our experience is in many respects similar to that of the DTI but we come at it from a rather different angle. DTI has been involved with European Community programmes in the science and R & D fields for longer than we have. Our Department—and I include in that the science base, the Research Councils—has become more involved in Framework Programmes in recent years and in Framework Programme 3, which is the one just beginning, there is significantly more basic science than in the earlier programmes. As far as the first area of whether the Framework Programme itself fulfils its broad objectives is concerned, I think, echoing what Dr Coleman says, the objectives are of a quite high level of generality. The intention is that it is to improve European competitiveness and it is a question of the relationship between the improvement of European science and that competitiveness and there is felt to be a pull-through which can be more or less direct. To that extent, yes, I think we are happy with the way it is developing. As far as whether or not the particular programmes match

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[Continued]

[Chairman *Contd*]

UK priorities is concerned, as I think Mr Foster explained, we do prepare extremely carefully both for the programme in general and for individual programmes, and this is where the co-ordinating machinery in the Cabinet Office comes into play. We play both with the Research Councils and, where it applies, on behalf of the Research Councils, an active part in that process. So there is a wide range of meetings to discuss the objectives that should be pursued in negotiations both at a broad level and in relation to particular programmes. That process took place intensively up to the point where a general political agreement on the most recent Framework Programme was taken. From there on, and indeed at the present moment, discussions are in progress on the content of individual programmes and again we are undertaking those very much in conjunction with the Research Councils' representatives, the scientific community, and we do our best to match the content of those programmes as closely as possible to UK domestic science priorities.

412. Although in fact the intention of the whole programme (these terrible words "subsidiarity" and "additionality") is that it should do something rather different from national programmes, is it not?

(*Mr Ritzema*) Well, when I say as closely matched as possible what I mean is the activity being undertaken. I quite accept that under the subsidiarity principle one is looking for the whole to be greater than the sum of the parts in the sense that one should only be doing things that it is more sensible to do at a European level, and consequently that where activity takes place it is in the areas that our Research Councils would want to see it carried forward. When I refer to our Research Councils I am regarding them as being representative of the interests of the science community at large because I recollect in questioning earlier there was reference to individual universities and I think, as I say, our normal liaison is with the Research Councils. But, yes, certainly we do attach a lot of importance to the subsidiarity principle and apply it and push for it wherever we can.

Lord Lewis of Newnham

413. We are in a slightly difficult situation because, to my knowledge, no Research Council has yet had to suffer from having a programme imposed on it that perhaps it would not want or even, as far as I am aware, possibly would not have suggested itself. But if you look at the figures—I take them from a document put to us, "Research in the UK", SERC Publications—we are told that the total R & D expenditure in the UK is only three-quarters of that in France and half of that in Germany. If I take that particular set of figures, it seems to me if there is in any way an equivalent imposition put on the programmes, the probability is that we are going to suffer in our situation far more than they would in Germany or France. That slightly worries me from the point of view of the motivation going into these particular programmes.

(*Mr Ritzema*) I do not have that document in front of me but, to take the general proposition that Councils would be unhappy if programmes were imposed on them, I think I can fairly say that to date that has not happened and it has not happened because the Councils are themselves involved in the discussions and negotiations that lead to programme content. Of course, one of the features of negotiating in the Community is that you cannot win every argument, you cannot win all the time. But in general terms, if we look at the Framework Programme that is now being negotiated, of the programmes in which the DES leads—and I devised those in the memorandum—we are broadly happy, the Research Councils are broadly happy, with the thrust of the content in the programmes that have been effectively agreed so far; that is, marine science and technology and some of the life science programmes. There is still discussion in progress on a large programme under the new Framework called the Human Capital and Mobility Programme and there, I think it is fair to say, there are differences of opinion between the United Kingdom and the Commission's proposal and these are being discussed fully and frankly with other Community partners in Brussels. But at the moment I do not think I see ground for saying there will be an imposition of programmes in the way you suggested.

Chairman

414. That is the Line 6 Programme?

(*Mr Ritzema*) That is the Line 6 Programme.

415. Where I understand that the Commissioner has ideas of his own which nobody else shares—is that the case?

(*Mr Ritzema*) I prefer not to give an opinion on whether anybody shares his opinions, but perhaps I could put it this way: in the discussions taking place at the moment we are working with some other Community partners to disaggregate the programme rather more and to direct it into particular lines, and I think the main thrust of that is to continue the kinds of activities going on under existing programmes which are valued by the science community and programmes I am referring to are the Science Programme, the Large Facilities Programme and the Economic Science Programme, and we are hoping that that kind of activity will find a place within the Line 6 Programme.

416. In their evidence to us more than one Research Council—both NERC and SERC certainly—perhaps looking to the future rather than taking the present position—have expressed their concern at the lack of direct influence they have on the formulation of the programmes themselves, and then on the scientific review of the programmes, so that the result as far as they are concerned they see as being that a programme is agreed to which both in its general purpose and in its actual execution is not one they would have put much money or much priority on, and yet at the end of the day by the time

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[Continued

[Chairman *Contd*]

the attribution has been applied, the amount of money they get from you for carrying out research of a high priority will be reduced. Do you say they are happy about this?

(*Mr Ritzema*) What I am saying, Lord Chairman, I think, is that that is something of a theoretical argument. As you said yourself, it is looking to the future. The practice to date has been that both the NERC and SERC, and for that matter the other Research Councils, have been fully consulted in the United Kingdom's negotiating objectives for these programmes and to a considerable extent have been kept up day to day with the discussions as they take place. I think everybody here would recognise, as I said, that you cannot win every negotiation, but I am not aware that in the programmes of particular interest, for example, to the NERC they are particularly unhappy with where we stand at the moment, for example, on the Marine Science Programme. I cannot say that there could not arise a situation in the future where Britain's other European partners would force through a programme that would be quite unacceptable in the United Kingdom, but I do think that it is a little bit unlikely and that there are steps we can take to try and avoid that happening.

One of those steps is to ensure we communicate regularly with our Community partners before programmes come into being and keep up a good state of bilateral as well as multilateral relations so that science questions do not polarise in the way suggested. In practice there are few international interchanges between science communities in which the UK does not play a part and as a Department we frequently need not be involved because scientists talk to scientists. While I cannot say the theoretical possibility does not exist it may not emerge in so stark a form as the question suggested.

417. You say in your paper to us: "that expenditure from the Community budget is treated on the same footing as any other form of public spending." Have you attempted to persuade the Treasury it should be treated in some other way? Do you accept that is the principle on which the whole thing should be organised?

(*Mr Ritzema*) Chairman, I think from the evidence you have already had that is the Government's approach to the control of expenditure in this area. I think you have also seen evidence from some outside sources that expresser slight regret at this situation, but nevertheless it is seen as an important instrument for expenditure control that a decision should be taken as to whether resources should be deployed nationally or whether they should be deployed on expenditure under EC programmes. Of course, I quite understand the views of those who would wish the two processes to be internally separate but I think there is a logic and rationale in the Government's position on this and I think it is an agreed Government expenditure position.

Lord Kirkwood

418. Do you see the Framework spending to be at a plateau or is it going to increase? If it is going to increase is it likely to be a significant proportion of the total money DES spends on research and development?

(*Mr Ritzema*) On the question of the size of the Framework, the actual size of the Framework III Programme is not a great deal higher in cash terms than the Framework II Programme but the key difference is that it is a rolling programme which overlaps the Framework II Programme, so in practice the amount of research being done is significantly greater. In terms of the offset argument on the science budget the effect of this on the science budget has so far been fairly small because our Department (and the Research Councils) have not been in the lead on many programmes. We do expect this to grow but it is not entirely the end of the story because, as I think you heard in evidence from the Treasury, there are two mechanisms in place which enable a decision to be taken as to what effect this has on the total of science expenditure available. I may ask my colleague to add to my remarks. Firstly, there is the important question of the baseline of expenditure. The only time that attribution, that is the taking away of Departmental resources, applies is where the total expenditure of the UK's share of EC programmes rises above the predetermined baseline. It is perfectly possible to change that on a macro-economic basis for European science projects as a whole. If it is not changed it is then a question of whether, in each individual department, it should be changed and in practice in public expenditure discussions there will be discussions about whether additional money above the baseline should be allowed from central resources, or alternating whether there should be an offset against domestic programmes. The answer is that, as expenditure increases, so decisions have to be taken as to whether this expenditure will increasingly replace domestic expenditure or should be additional to it. That is an issue that will be addressed year by year in discussions between the Department of Education and the Treasury.

419. You do not see the whole thing extending apart from the fact these are overlapping programmes which are presumably now in place. The transient period is over and, it has now settled down in a fairly steady state situation.

(*Mr Ritzema*) No, I do not think that is quite what I said. I do not think that is a question I find at all easy to answer. I think it is inevitable there will be pressures from parts of the world, not necessarily from the UK or the UK science community but from some parts, for overall increases in science spending and I cannot anticipate how those will come out. There may continue to be an increase in the proportion of the basic science undertaken although I have no way of knowing at this stage whether there will be, or not. Perhaps I could say that if there are

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MR R P RITZEMA and MR K ROOT

[Continued

[Lord Kirkwood *Contd*]

the question but I do not think the answer is clear. There are a number of pressures at work here, and it is hard to anticipate how it will go.

Lord Sherfield

420. We have heard the Treasury on additionality and as you have very clearly said you are aware of a good deal of unhappiness about the application and the end result of additionality. The Treasury have made it clear they are taking an overall view and leaving it to the Departments to carry the can, so to speak, and deal with the unhappiness which arises from the applications of the present system. To what extent does the system, for better or worse lead to a lot of inflexibility? Are you, as a Department, able to deal with the matter more flexibly and deal fairly with the complaints which reach you as regards contributions and so on?

(*Mr Ritzema*) The complaints that are made about this are made, at least as far as our Department is concerned, more to the future than to the present in the sense the contribution towards the science budget has been quite small to date but is expected to increase. I think this point was probably made clear by the Treasury, that the system that applies is the same that applies in respect of all EC programmes, it is not a special system for science. In practice, and following discussions within the Government at the beginning of each Framework Programme about how the shares of the Programme should be distributed according to departmental responsibilities, there is some flexibility internally within DES as to how offset is actually made against particular departmental budget heads. I rather doubt whether those matters are the kinds of answers the critics of this system would want to hear because I think, if I may interpret their views myself, they would wish all expenditure secured from European sources to be additional to the expenditure available from domestic sources. While that view is understandable it is not a view held on general expenditure grounds by the Government.

Chairman

421. Is not one of the problems, as it were, they do not get the bill for their participation in the Framework Programme as far as the Research Council is concerned until quite a lot later, so they do not know what they are doing? It may be in a few years they will be docked for something they were committed to a year or two before, or is that not the case?

(*Mr Ritzema*) That is true in the sense that a decision is taken at the outset of the Framework in relation to particular programmes as to what the spread of those programmes, the financial commitment of those programmes, is going to be over the lifetime of the Framework, and it is true that there is in a sense an obligation that the science budget has to meet, regardless of any particular level of settlement reached in any particular year. We are though talking about figures for attribution offset which are really quite small in relation to the overall

size of the science budget. I certainly do not want to suggest the concerns expressed for the future are not honestly intended, but at the moment those sums of offset are not great and it is possible for the sums in a sense to be deducted before the sums are distributed, so it is not a question, as I think arose through a misunderstanding in an earlier session, of particular councils being hit by particular successes in Europe. It does not work like that.

422. Could we switch to a different aspect altogether? We have really been talking mostly about top-down programmes. One of the criticisms we have had from quite a large variety of sources is that in genuine bottom-up programmes—this is not necessarily European framework but applies also to European framework—when a fruitful form of international programme appears to be something that could be got together, first of all there is great difficulty in knowing how to do it, but, that having been got going and the particular Research Council concerned having perhaps given its approval, if it is something that cannot be financed by the Research Council itself without further reference and it gets up to your level, it disappears into a great cloud of bureaucracy and then nobody knows what is happening for a very long time and everybody is left in the dark as to the future of the project.

(*Mr Ritzema*) I find it a little hard to comment in general terms on that, Chairman, without specific examples. I am aware, I think it fair to say, that criticism was made about participation in the Ocean Drilling Programme. I think that is one of the examples that has been quoted. Perhaps I could just make one or two comments about that, then speak about the issue more generally. That particular programme undoubtedly ran into difficulties of the kind I think you described and I think the difficulty that arose there—and we are talking about the beginning of the second phase of that programme—is that the Research Council, the NERC, that wanted to participate in the programme, did not feel it could find from its own resources sufficient for the United Kingdom's subscription and I think it was complicated in that situation by differences of view as to whether that programme was wholly basic science or partly applied science or industrially relevant science, and something of a compromise was reached which I think proved to be an uneasy compromise. I think it would be fair to say the Cabinet Office Guidelines with which the Committee has been supplied, in referring to the need for a lead department to be identified and for financial commitments to be entered into for the duration of the phase of the programme, were drawn up partly with that experience in mind. By that I mean that if you know that there is going to have to be a commitment, whether on government or on a Research Council, for five years, then it is up to participants, however you decide to distribute the UK contribution, to ensure that the commitment ought to be over the same period because. While it is reasonable for people to opt out at the end of a commitment period after a process of discussion, if

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[Continued

[Chairman *Contd*]

that is how they genuinely feel (and you have to allow that flexibility for people to budget), it is a bit hard if you drop out halfway through leaving the committed signatory to carry the can. I think that is the lesson that has been learned from that particular experience. As regards other proposals that have arisen in my time in the Branch, I cannot, I must say, think of any that have ascended so much into the stratosphere that they disappeared entirely from view. That is not to say there have not been funding difficulties with some of them, but there are mechanisms in place for considering these matters and where a Council believes that it has a very strong scientific case to undertake or participate in a particular programme but does not feel it can deploy its own resources, then the right approach is for it to go to the ABRC and ask for them to consider the matter and advise the Secretary of State whether additional resources should be awarded for that particular programme or not. I think the ABRC would normally want to look very critically to establish whether or not that Council did have sufficient resources of itself, but there have been circumstances where they have said "Yes, we believe additional resources for this programme are justified" and have so recommended to our Secretary of State and resources have become available. So the system does work, I think.

423. Your argument would be that in most cases it is the responsibility of Research Councils themselves to see that these things are dealt with fairly expeditiously, or as expeditiously as is reasonable for an inter-national project?

(*Mr Ritzema*) In my experience they deal with them as expeditiously as they can, bearing in mind that international discussions are often slow because you are dealing with people who have quite different systems and have their own mechanisms. When it comes to securing additional resource allocations, there is an annual expenditure exercise and it falls under that particular procedure and, since the idea is to look across the science base at that has it all to be done at the same time.

424. What about this question I put to the DTI: the criticisms of the Royal Society—which they glanced to leg for you to answer—that there is some vacuum in the centre which means that when it is a question of participation in an international programme, particularly if the proposal comes from outside, it is very difficult to get an answer, and certainly to get an answer within a fairly reasonable period of time, because either the machinery for doing so does not exist or it does not work properly?

(*Mr Ritzema*) My Lord Chairman, I can only comment in relation to issues that have arisen within the DES sphere of activity. I have spoken already about the Ocean Drilling Programme, which firstly was a few years ago and I think was one of the examples they had in mind. I am not entirely sure what the other examples were, but I think while no system is perfect, as Dr Coleman said, we would like to feel that there is not such a vacuum. But of course

it does depend on the machinery that is in place working properly. I cannot say there have not been situations where a particular proposal has not been brought to the attention of other people that should have had a part to play in it, but it is easier to comment on that in relation to particular cases because they all differ.

425. You are not aware, apart from the Ocean Drilling Programme, of any major programme where this has been a valid criticism?

(*Mr Ritzema*) I do not think I personally am. I think in the programmes that I have had experience of—and I think the same probably goes for my colleague—we have in a number of cases set up either *ad hoc*, or used existing, machinery involving carefully considered arrangements for involving all the right people in proceeding to decisions. Perhaps I could offer two examples. One is the situation where two or three years ago it was necessary to renegotiate our membership of CERN and to try and seek expenditure reductions in that area. Another was in the negotiations leading to the establishment of the ESRF which is now going ahead in Grenoble. In both those cases there were mechanisms in place that involved Cabinet Office, Foreign Office, relevant Research Councils, ourselves—the Royal Society I think were involved, certainly in some cases; they were when they wanted to be—and we found that those mechanisms delivered the goods in the sense that all the situations were different but they all led to decisions in the end and I think very satisfactory decisions.

426. Has it worked satisfactorily for the Human Frontier Science Programme?

(*Mr Ritzema*) So far I think it has worked reasonably well. The Human Frontier Science Programme is a rather unusual programme, not a large one but it has particular points of significance, not least the fact that it involves collaboration with Japan.

Of course, that was the question which you were talking to the DTI about. The UK's position on the Human Frontier Science Programme is that there is a first phase in progress at the moment up until 1992 and the UK's contribution is a contribution in kind through fellowships and that sort of thing rather than input in cash terms. We get advice on the scientific quality of that programme from the Scientific Committee which contains two UK scientists, one of whom I believe is a member of your Lordship's Committee and so far the situation has proceeded satisfactorily. I think there is a question arising as to what will happen after 1992 in terms of a possible second phase of this programme but at the moment discussions on that have yet to begin.

Lord Lewis of Newnham

427. I have a basic point, I would like to ask you about the whole philosophy underlying this approach. We were told by the DTI many of their programmes were going to be of ten year duration

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MR R P RITZEMA and MR K ROOT

[Continued]

[Lord Lewis of Newnham *Contd*]

whereas, if I understand it correctly, the period of duration in the agency is of three, four or five years. Clearly this appears to depend on how far industry wishes to put its own money into it. If we look at the pure science programme where we have people who have been brought together, and I believe the term is "Stimulation" of international co-operation. If it is successful it is not clear to me how they progress from that stage because the particular Framework Programme will finish. One could argue you are breathing a sense of frustration into people, unless they have other sources to allow them to collaborate. I am not sure at the moment whether such sources do exist.

(*Mr Ritzema*) Well, Chairman, the Stimulation Programme, and I appreciate you are referring to the process of stimulation but there was a programme called the Stimulation Programme now called the SCIENCE Programme, and that was and is designed with one main thrust, to bring together working scientists, both departments, science centres and so on.

428. This is the particular one I am referring to.

(*Mr Ritzema*) Particularly, to use their jargon, networking of science centres. The idea here is to support this partly to bring forward experts, allow cross-fertilisation and its operation. It is highly regarded in the science community. We are keen in the new Line 6 Programme that that type of activity should continue. Your question was where does it lead to, what happens once that particular phase is over. In practice the experience has not been going long enough to give a categorical answer. I think, as I see it and I would like to take expert advice on this before producing a categorical judgment, the purpose of this is a bit like pump priming in the sense you put in money for a limited duration to get these networks going and then they thrive under their other financial sources because these science centres did not come into being as a result of European Community action, these are existing centres funded through national resources. The purpose is to get them working together to produce results better than just working nationally. I think one has to say that it would be improper for such funding to become permanent because that would pre-empt the use of those funds for other opportunities. I think we hope this is a process they will develop and extend but which will not always be funded through the European Community.

429. I understand that and fully appreciate you cannot continue in this way but it seems to me, particularly as some of these programmes are encouraged to involve some of the poorer members of the European Community such as Portugal, Greece or Southern Ireland, difficult when one terminates these programmes to ensure interaction between these people. I agree it could be argued it is better to have some interaction for a short period of time than no interaction. It does seem if we go back to the relative size of the findings, it would be much easier in Germany and France to continue this than

it would be in the UK. I am conscious there will be pressures to find alternative sources of money in order to maintain this arrangement. If it is not going to come from the EEC there is only one other source I see for that to come from and that would be the Research Councils.

(*Mr Ritzema*) If I could respond to that. It would be the Research Councils in relation to centres in the United Kingdom, but you were also talking about centres in Portugal or Greece or whichever country one selects. Firstly, our perception is that science centre in those countries would not form a network unless they were reasonably established and would not be so precisely on a par with the strongest centres in France and Germany but reasonably established, in other words it would not be usually part of the networking activity to start centres up from scratch and it would be the responsibility of the national funding of that country to provide continuity. If these networks prove successful I think it will enhance these centres and makes them centres of strength. There will be other scientific opportunities in which they can participate. I do not think I am just referring to EC programmes. I would want to avoid giving the impression the only way centre-to-centre collaboration takes place is through European Community programmes. It was happening long before the European Science Programmes started. Whilst they are accelerating the process there are other ways in which it can take place; there are other scientific organisations and scientific opportunities. I do not think the network will collapse like a punctured balloon if money is withdrawn. I think for the programme being negotiated at the moment, the Line 6 Programme, one idea is continuity funding where people have undergone a research training period and then move to another laboratory and are funded to set this up to produce centres of strength themselves. That seems to me to be a healthy concept.

Chairman

430. Can we get back to this question of where decisions are made. Do you find it a disadvantage in dealings with other countries that, whereas most other countries have a Minister for Science, we do not, or a separate Ministry of Science?

(*Mr Ritzema*) Chairman, as you know the Government has decided the right sort of strategic framework in which decisions should be taken is one where science responsibilities are distributed across the department and there is a central co-ordinating function in the Cabinet Office. We work within that system and I think we find it a system that works. We understand it and it is reasonably clear. It does produce the kinds of decisions and processes we want to see. I am, of course, aware people sometimes point to the example of, say, Germany or France where Germany has the BMFT and France the Ministry of Research and Technology. In both those countries it would be wrong to say all science decisions are centred in those institutions. In Germany, for example, an external influence on the

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MR R P RITZEMA and MR K ROOT

[Continued

[Chairman Contd]

running of scientific programmes is quite a significant one. I have been struck in my own dealings with scientific programmes by the position of the Länder and the Quai d'Orsay on matters that fall to be decided. I know some of the contributions for collaboration are not paid by the Ministry of Research and Technology but by the financial ministries, as happens in Italy, or the Foreign Ministry as happens in France. It is difficult to comment in general terms on the proposition not knowing exactly what sort of single science ministry one is talking about but we find the present arrangements work.

431. For example, when it comes to making the final decision about the Human Science Frontier Programme, where will that decision be made?

(Mr Ritzema) That has a decision made by the Secretary of State for Education and Science.

432. On the advice of ABRC?

(Mr Ritzema) On our scientific advice in conjunction with those involved. A number of science research councils were involved, indeed that will apply wherever there is a desire or necessity to have a Governmental signature on whatever agreement it is.

Many collaborations do not require a ministerial signature. The big ones do—CERN, ILL, ESRF. Those are treaty organisations, if I could use that in the non-legal sense; they are organisations where ministers sign the relevant documents. That does not apply in many collaborations, it does not apply in most, which are affairs decided between Research Councils and universities.

433. That is very helpful. We will not go into the detail now, if you could perhaps let the Clerk have a note of exactly how the decision was arrived at on ESRF as an example?

(Mr Ritzema) That could certainly be done, Chairman.

Chairman] Thank you very much indeed, Mr Ritzema. You have been very helpful.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY

(SUB-COMMITTEE II)

Thursday 15 November 1990

AEA TECHNOLOGY

Dr B L Eyre, Mr J R Bretherton and Dr R Bullough

DEPARTMENT OF ENERGY

Dr W D Evans and Dr E H Walker

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Present:

Carver, L (Chairman)
Dainton, L
Flowers, L
Kirkwood, L

Nelson of Stafford, L
Sherfield, L
Taylor of Blackburn, L

Memorandum by AEA Technology

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STRUCTURE OF EVIDENCE

1. This evidence covers international scientific programmes carried out by AEA Technology. As the Contents list shows, the evidence is in two main blocks. A covering AEA Fusion and B other AEA programmes of international collaborative R&D.

BACKGROUND

2. AEA Technology's R&D programmes are now carried out in nine businesses, each with its own Chief Executive. These are:

- AEA Fusion
- AEA Fast Reactors
- AEA Thermal Reactor Services
- AEA Fuel Services
- AEA Decommissioning & Radwaste
- AEA Environment & Energy
- AEA Petroleum Services
- AEA Industrial Technology

3. All of these businesses are involved in international collaborative R&D in one form or another and examples of these interactions are given in Section A and Annexes B1 to B7. (There is no input from AEA

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Industrial Technology because although we obtain contracts from CEC initiatives such as BRITE the rest of the funding comes from industry rather than government and this was therefore felt to fall outside the scope of the present inquiry.) However, fusion stands apart because the entire programme is co-ordinated by the European Community and because we are the hosts for JET. This means that the UK commitment is to a significant extent determined by international agreement and that it is long term (extending until the decommissioning of JET).

4. In general the UK government funding of AEA programmes is provided by DEn, but the annexes also refer to work where funding comes from other departments including DoE, Department of Health and the Health and Safety Commission.

5. Although the international aspect is absolutely fundamental to many programmes besides fusion, e.g., the fast reactor, in general any legally-binding commitments are not long term. In most of the programmes the UK is funding its own R&D and it is the technical co-operation and information exchange which is international.

GENERAL CONCLUSIONS (Mainly relevant to the Committee's question (i), but see paras A7 to A19 for additional points arising from the Fusion programme, Annex B1 for issues relevant to the European fast reactor, and Annex B6 on environmental programmes which includes replies to most of the questions.)

6. These collaborations are pursued mainly because it is to the UK's technical advantage. The only possible exception is Safeguards where UK involvement was determined initially by political objectives related to the Non-Proliferation Treaty. Where the funding, or part of it, is coming from a Government Department, the advantage to the Department will be that it funds a UK programme but obtains information from a much larger international programme. If the programme is well-co-ordinated, as we would endeavour to ensure it was, this should avoid wasteful overlap and be cost-effective. Clearly this way of working is most relevant to long-term programmes (e.g., fast reactor) or to those on the environment or safety where competitive pressures take a back seat.

7. For most of these programmes the commitments are relatively short term (up to two or three years) and the UK can drop out if and when the benefits no longer justify the commitment of resources.

8. Usually the reasons for joining are technical, e.g., sharing the use of large experimental rigs, pooling work on large computer programmes or the topic is global such as atmospheric pollution, and the various problems raised in the Committee's questions do not arise. Often there are longer term political or commercial benefits but these are a bonus and not necessary to the original justification for joining the collaboration. However, in Europe post-1992 involvement with European partners and the market knowledge gained from this will be increasingly important.

9. One caveat is that if the UK embarks on a collaborative project it is important that we are prepared to "pull our weight" by carrying out a share of the work which our partners feel is reasonable in terms of UK interest in the field or broadly proportionate to GNP. It would be a serious mistake if we saw international co-operation just as a way of cutting R&D funding. Its main objective should be to increase the benefits from a prudent level of R&D commitment.

A. AEA FUSION AND JET

A1 The AEA's fusion programme is fully integrated with the European Community's co-ordinated fusion programme. It is funded by DEn with a contribution from Euratom. The UK is also host to the JET project.

EUROPEAN COMMUNITY R&D

General

A2 The European Community scientific and technological R&D programmes are planned on a rolling five year basis under the "Framework Programme" (Framework Programme of Community Activities in the Field of Research and Technological Development) which requires the approval of the Council of Ministers and endorsement by the European Parliament. The 1990-94 Framework Programme was approved on 23 April 1990. The elements are set out in Annex A1.

Funding

A3 Funding of the Framework Programme comes from the annual Community budget, again requiring approval of the Council and Parliament, to which member states contribute (some 1 per cent of VAT). Member states also contribute directly to their national R&D programmes.

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[Continued

Committees

A4 The Commission have established a number of advisory bodies, made up of representatives of national R&D organisations and government officials, who assist the Commission with the formulation and implementation of the various R&D sub-programmes. On submission of R&D dossiers to the Council of Ministers, member states, through their Parliament Representative in Brussels, have a further opportunity to examine proposals in detail. When agreement is reached on the funding and content, the proposed programme is put to Council for approval. With the exception of those R&D proposals covered by the Euratom Treaty, opinions must be sought from the European Parliament and from a standing consultative body, the Economic and Social Committee. For programmes covered by the Euratom Treaty an opinion must be sought from a further standing body, the Scientific and Technical Committee, and the European Parliament and the Economic and Social Committee are also consulted.

The Community Fusion Programme

A5 The Community Fusion Programme (CFP) is included in the Framework Programme and is implemented by a series of Contracts of Association between the European Atomic Energy Community (EURATOM) and the national organisations in member states active in fusion, by the Joint European Torus (JET) Joint Undertaking, and through an agreement establishing the NET (Next European Torus) team. A small part of the European Joint Research Centres (JRC) is also dedicated to fusion technology.

A6 The Contracts of Association integrate the work of organisations forming the Associations into a coherent Europe-wide programme of research. Each Association receives Fusion Programme funds at a level between 25 per cent and 45 per cent as a contribution to its own work and has access to results achieved elsewhere in the programme. No national programme operates in isolation. There are 12 Associations distributed in 10 countries (including Sweden and Switzerland). The funding arrangements are described in more detail in Annex 2.

The Committee's Questions

A7 The following sections refer to the Committee's questions (i) *et seq*—the relevant question is indicated in brackets.

Advantages and disadvantages in joining ISPs

(i)

A8 Accession to the Eurotom Treaty, with the resulting integration of the UK's fusion programme with that of the then Community programme, was a political act. However, other advantages followed:

- (a) The costs are shared. For example in 1988 a contribution of £22M direct and about £24M indirect gave the UK access to a programmes of £280M. In addition to the general sharing of costs, the Community Fusion Programme allows investment in very large experiments/facilities which no single member state could afford.
- (b) The full participation by member states and the Commission in the organisation and management of the programme has largely resulted in the elimination of duplication of effort and has strongly encouraged the sharing of resources, scientific knowledge and hardware between the Associations in the member states.
- (c) The Community has developed strong links with the other major fusion programmes in the USA, USSR and Japan. In addition to a series of joint projects and exchanges of staff, this open collaboration, with encouragement of USA/USSR summit meetings, has allowed the setting up of an international conceptual design study of a test reactor (International Thermonuclear Experimental Reactor—ITER) by the four major fusion programmes under the umbrella of the International Atomic Energy Agency.
- (d) Other advantages include access to a broader peer review of programmes and progress, enhancing UK expertise and providing links to overseas commercial markets.

A9 The disadvantages include:

- (a) independence of action reduced;
- (b) European tendering (a requirement) is a time-consuming and costly process;
- (c) sharing intellectual property rights and investment may reduce eventual commercial benefits (e.g., Euratom requires profit to be shared);
- (d) funding decisions may be influenced by a broader range of political consideration.

The advantages and disadvantages of hosting large facilities

(ii)

A10 The AEA is host to the Joint European Torus Joint Undertaking (JET), which has been sited alongside the Authority's Culham Laboratory, since 1978. The funding arrangements for JET are described in Annex A3.

A11 The advantages of hosting such a project are seen as:

- (a) providing direct and ready access to the leading experiment in the world and generally rapid access to the detailed scientific and technological results;

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[Continued

- (b) attracting high quality staff;
- (c) providing opportunities for UK industry;
- (d) providing foreign exchange income to UK;
- (e) providing local employment and a welcome influx of Community scientists and their families.

A12 The disadvantages are:

- (a) It involves a long-term commitment. In the case of JET the host organisation is not allowed to withdraw.
- (b) The staffing arrangements for JET result in continental staff being paid at European Commission rates and enjoying low tax advantages. This has caused difficulties both for the Authority and Authority staff seconded to the JET team (also relevant to (ix)).
- (c) our own programme has been reduced and narrowed into a supporting role.

The Machinery

(iii)

A13 The Community Fusion Programme is managed by the Fusion Directorate, Science, Research and Development Directorate (DG-XII). The Commission is assisted by an advisory body—the Consultation Committee for the Fusion Programme (CCFP)—made up of representatives of the Associations and government officials of the Member States, and Sweden and Switzerland. There are a number of sub-groups which deal with more detailed aspects of the programme.

A14 The machinery for programme approval (described in para A4) is inevitably cumbersome and slow-moving with the individual interests and concerns of the member states and the tensions which exist between the three major community institutions. The system, a five year rolling programme with a review in the third year, makes some allowance for this. However, the management of R&D programmes can be adversely affected by the long delay in new programme approval.

Technical and Financial Criteria

(iv)

Technical

A15 AEA Technology programme proposals must fit within the general European strategy and meet UK government policy as indicated by the Department of Energy. The Department takes advice from a technical advisor, from the ACORD Committee and also consults other interested Whitehall departments (FCO, Cabinet Office, Treasury). Current policy requires the programme to focus on the tokamak route, and in particular, to give high priority to supporting the JET Project with curtailment of the UK national programme.

Financial

A16 The budget of AEA Technology's Contract of Association Programme must be within the PES guidelines set by Treasury and conform to the funding ceilings set out in the Contract of Association and the Commission budgetary situation. The Euratom contribution is proportional to the programme volume and therefore falls with the falling UK funding level.

Forums

(v)

A17 The major forums are described elsewhere in this note. AEA Technology discusses its proposals with the Commission at the Culham Euratom Steering Committee and by a series of regular meetings with the Department of Energy. AEA Technology also participates in the network of Community committees which support the CFP.

Other Aspects

Treasury attribution

(vii)

A18 Treasury attribution is a system which involves Departments' PES baselines being reduced at the beginning of the survey by an amount which corresponds to the cost to the UK of financing community spending above pre-determined levels. These rules have become the dominant feature in the UK's negotiating stance concerning all new R&D programmes. This policy is applied inflexibly to all programme proposals irrespective of scientific and technological merit or to the contribution the UK scientific community might have to offer. It has created, not surprisingly, an atmosphere of suspicion and hostility amongst our European partners.

Exposure to currency fluctuations

(vii)

A19 In the past the Authority's programme has had to be reduced to find additional funds for its financial contribution to JET due to adverse currency fluctuations.

*15 November 1990]**[Continued]*

ANNEX A1

THE EUROPEAN FUSION PROGRAMME: ORGANISATION AND FUNDING

1. The European Community scientific and technological R&D programmes, including the Fusion Programme, are planned on a rolling five year basis under the "Framework Programme" (Framework Programme of Community Activities in the Field of Research and Technological Development) which requires the approval of the Council of Ministers and endorsement by the European Parliament. Actual funding of the programmes is by way of the annual Community budget, again requiring approval of the Council and Parliament, to which Member States contribute (i.e., some 1 per cent of VAT). The current Framework Programme covers the period 1987 to 1991.

2. The Fusion Programme is implemented by means of Contracts of Association between the European Atomic Energy Community (EURATOM) and the national organisations active in fusion, by the JET Joint Undertaking and through a multilateral agreement concerning NET. A small part of the programme of the Euratom Joint Research Centres (JRC) is also dedicated to fusion technology.

3. The Contracts of Association integrate the work of organisations forming the Associations into a coherent Europe-wide programme of research. Each Association receives Fusion Programme funds as a contribution to its own work and has access to the results achieved elsewhere in the programme. No national programme operates in isolation. There are 12 Associations distributed in 10 countries (including Sweden and Switzerland); preliminary discussions are underway with Greece and Portugal for the possible setting up of two new Associations.

4. The pattern of funding fusion work in Europe in 1988 (the latest year for which full figures are available) is described in Annex 2.

5. The pattern of funding of fusion work undertaken by AEA Technology, and by the JET Joint Undertaking at Culham, in the same year, is described in Annex 3.

6. In addition to activities within the EEC Framework Programme, wider international co-operation on fusion research is being promoted by the IEA and the IAEA. As well as assessing the place of fusion in the world's future energy scene, a major activity of the IEA has been to enhance the effectiveness of fusion research by establishing agreements to co-ordinate programmes, staff exchange, seminars, etc. A prominent series of world-wide conferences on fusion is organised under the auspices of the IAEA. The IAEA also promotes broad initiatives such as studies in preparation for the next step in fusion research.

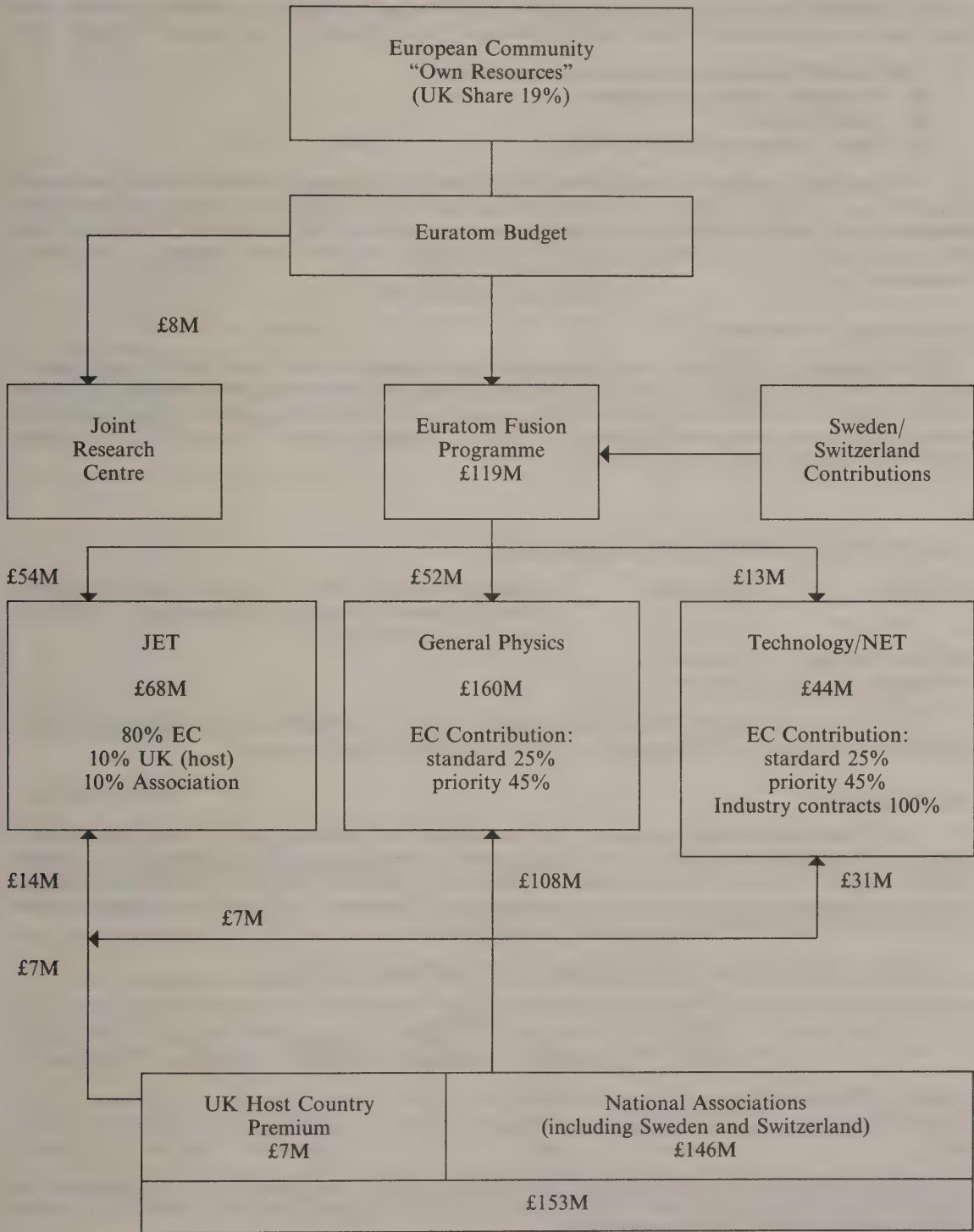
ANNEX A2

FUNDING ARRANGEMENTS: THE EURATOM FUSION PROGRAMME

1. The following paragraphs describe the funding arrangements for the various elements of the Fusion Programme. They amplify the flow chart of funding shown in Figure 1 and should be read in conjunction with it.

Figure 1

EC (EURATOM) FUSION PROGRAMME:
FUNDING ARRANGEMENTS (1988 Expenditure)



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[Continued

General

2. Funding for the Fusion Programme flows partly from Community budget and partly from the national governments of the Member States and of Sweden and Switzerland.
3. The EC budget is funded by so-called “own resources” (e.g., the same 1 per cent levy on VAT in Member States, EC duties and taxes) of which the UK component is approximately 19 per cent. The funds allocated to the Fusion Programme within the Community budget are slightly augmented by contributions from Sweden and Switzerland. Part of the Joint Research Centre’s budget is also allocated to fusion work.
4. The Fusion Programme has three main components:
- (i) the general physics programmes;
 - (ii) the JET project;
 - (iii) fusion technology (including NET).
5. The national organisations participating in the Fusion Programme in Member States, Sweden and Switzerland are mainly funded by their respective national governments. Each Contract of Association contains an upper financial limit beyond which Community support will not be available. The share of these costs contributed by the Community budget varies between the three main elements of the Fusion Programme.

General Physics Programme

6. The standard rate of support for the running costs of Associations is 25 per cent. An additional 20 per cent of the cost of hardware for particular experimental devices may be made available if they are judged to be of priority value to the programme. The sharing of costs between the national organisations and Euratom will vary depending on the amount of “priority” support recorded. For the UK the division is about 70 per cent AEA, 30 per cent Euratom.

JET

The JET Project is funded on the following basis:

Commission	80 per cent	(since the UK makes a 19 per cent direct contribution to the overall Community Budget, it effectively pays 15 per cent within this contribution)
UK Host Premium	10 per cent	
Associations	10 per cent	

7. The 10 per cent payable by the Associations is charged in proportion to the Euratom financial participation in the costs of the Association. The AEA share is about 1 per cent.

Technology/NET

8. The Commission awards contracts to the Associations for individual items of work with financial support at the standard rate of 25 per cent (or 45 per cent for priority items). Work undertaken by industry is wholly funded by Euratom through contracts. The operational costs of the NET Design Team, sited at Garching in Germany, are supported by the Commission at 75 per cent. Staff from Associations who have been seconded to the NET team are supported at 45 per cent.
9. Thus in 1988 the sums allocated to fusion were distributed as follows:

	General Physics (£ million)	JET (£ million)	Technology ¹ NET (£ million)	Sub-total (£ million)	JRC (£ million)	Total (£ million)
Associations’ Share	108	14	31	153	—	153
Euratom Share	52	54	13	119	8	127
Total	160	68	44	272	8	280

¹The objective of the “Technology” programme is to develop understanding of the characteristics of the materials used as components in fusion devices (e.g., tritium) and of techniques in using them (e.g., remote handling equipment). It also includes studies of safety, environmental and economic aspects.

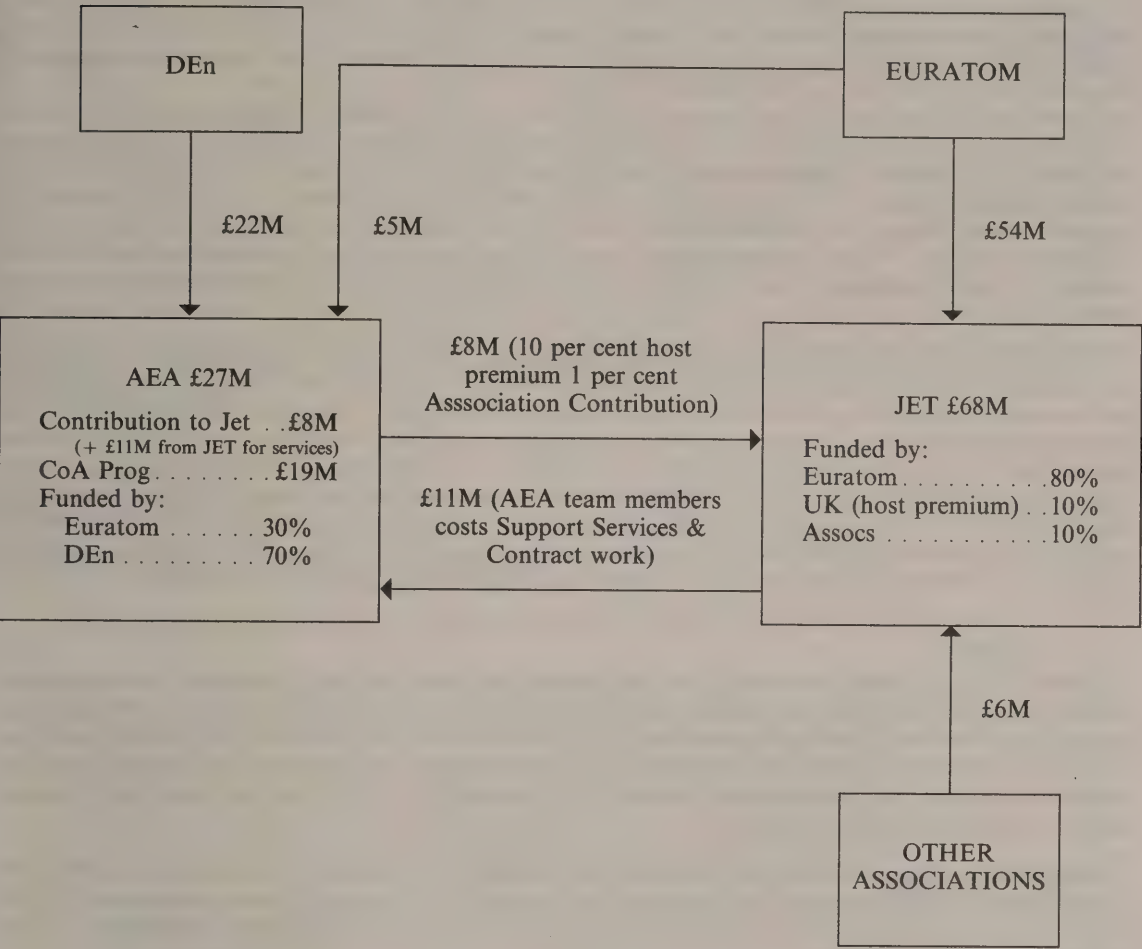
ANNEX A3

FUNDING ARRANGEMENTS: THE AEA PROGRAMME AND JET

1. The following paragraphs describe the funding arrangements for the AEA’s Fusion work and its relationship with the JET project. They amplify the flow chart of funding given in Figure 2 and should be read in conjunction with it.

Figure 2

Indicative Analysis of Area Fusion and Jet Income in 1988



September 1990

- 2. Funds flow to AEA for fusion work from (1) the Department of Energy, (2) Euratom and (3) JET.
- 3. Funds are spent on work carried out under the Contract of Association (CoA) Programme, on AEA's financial contribution to JET, and on work in support of the JET project.
- 4. The Department's funding for the CoA programme is supplemented by the Euratom contribution (at a rate of 25 per cent for standard items and 45 per cent for priority items). The total contribution is about 30 per cent of the CoA programme as a whole, and is governed by the amount of Departmental funding. Thus a reduction in government spending on AEA's CoA programme reduces the Euratom support.
- 5. Income received by JET comprises 80 per cent from Euratom, 11 per cent from the Department of Energy through AEA (10 per cent as the host country premium and about 1 per cent as an Association) and 9 per cent from other Associations.
- 6. The income received by the Authority from JET covers the salary cost of AEA staff seconded to the JET team and the cost of site services provided by AEA. In addition JET places contract work with the AEA.

ANNEX B1

AEA FAST REACTOR

The following text describes the UK's participation in European collaboration on fast reactors. Where a section responds to one of the Committee's questions the appropriate number is given in brackets on the right-hand side.

*15 November 1990]**[Continued]**Background*

2. The governments of the UK, France, Germany, Belgium and Italy signed a Memorandum of Understanding in January 1984, covering collaboration on fast reactor technology. This was followed by the signing in March of the same year of a Reactor Memorandum of Understanding by the European R&D and design organisations. This MoU provided for the conclusion of, among others, a detailed agreement covering R&D collaboration, which was signed in February 1989. The MoU and this latter agreement have been the basis for the AEA's collaboration with partners in Europe for the last six years, and it is the experience with this part of the fast reactor collaboration which is outlined below. However, it represents only one part of a wider collaboration involving the design organisations (NNC (UK), Novatome (France, Interatom (W. Germany), Belgonucleaire (Belgium) and ANSALDO (Italy)), and the electricity utilities (Nuclear Electric (UK), EdF (France, RWE and Preussen Elektra (Germany) and ENEL (Italy)) who represent the customers for commercial fast reactors. The intergovernmental MoU also allowed for collaboration on fast reactor fuel cycle technology. However, progress with collaboration in this field is unlikely to be significant until there is a firm commitment to proceed with the construction of a series of commercial reactors.

3. At the outset in 1984, the Agreement envisaged the construction of three demonstration commercial fast reactor power stations in succession, located in Germany, France and the UK, with progressive improvements based on the experience with each. However, in 1988 the electricity utilities agreed that it was more appropriate to focus the effort available in the design and R&D organisations on a single power station, the European Fast Reactor (EFR). A sequence of design phases, including the necessary R&D support was defined. The selection of the location for the power station is envisaged for 1993-94, with start of construction in 1997 and full power operation in 2005. This timescale would allow some five years of operational experience before 2010 when decisions would start to be needed across Europe on the replacement of the existing thermal reactor power stations commissioned in the 1970s-1980s.

The EFR Project

4. The emerging design for EFR draws heavily on three national designs for a commercial demonstration fast reactor. These were CDFR (UK), SNR2 (Germany) and Superphenix 2 (France). The specification for the EFR design has been drawn up jointly by the European electricity utilities, who have formed an informal grouping—the European Fast Reactor Utilities Group (EFRUG), to co-ordinate fast reactor matters. The group has specified the capacity of the plant (1500 MW) and the main design features, based on existing European experience.

5. The design organisations, after working closely together for several years, have now established themselves as EFR Associates with a single project design office in Lyon staffed by a joint team. It is the designers who specify the R&D needed to support, and confirm the suitability of, the choice of design features endorsed by EFRUG.

6. The R&D organisations have been working very closely together since the MoUs were signed in 1984. This close co-operation has allowed responsibilities for different aspects of the development programme to be shared between the partners, in turn allowing considerable rationalisation relative to the earlier national programmes. This has created a position of interdependence, with individual partner nations specialising in particular aspects of the technology, and reducing team strengths in other areas down to a minimum level consistent with an ability to maintain an appreciation of development progress.

7. A key design objective for EFR is that it should be suitable for construction in any of the partner countries, and therefore it must be acceptable to all the various licensing authorities.

Management Procedures for the EFR R&D Programme

8. At the most senior level, the R&D programme is co-ordinated by a Steering Committee, meeting twice yearly and comprising staff at Programme Director level from the R&D organisations. Senior representatives of the design companies are also members of the Steering Committee, and are able to advise on priorities. The Chairmanship is rotated approximately annually between the partner R&D organisations.

9. A small management committee, comprising two senior R&D representatives from each partner country co-ordinates work on a regular basis, meeting approximately bimonthly.

10. The more detailed progressing and co-ordination of the technical programmes is carried out by specialist working groups, which recommend how, and in which laboratory, the R&D work requested by the designers can be carried out most effectively. Eleven of these specialist working groups have been established to cover the range of fast reactor technology. The groups comprise of the senior specialist from each partner R&D organisation, co-opting other specialists as necessary, depending on the nature of the problems to be tackled. Chairmanship rotates every few years and formal meetings are usually held two or three times per annum. *Ad hoc* specialist sub-groups are formed from time to time to advise on specific aspects of a problem.

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[Continued

11. The need for full-time technical/administrative management has been kept to a minimum. An executive director has been appointed (from the Karlsruhe Centre in Germany) to ensure overall day to day co-ordination of the various technical programmes, and he acts as permanent Chairman of the management committee referred to above. He is supported by a small full-time Technical Secretariat at Cadarache in France, including one member from the UK. He is also supported on a part-time basis by three experienced technologists (one each from France, UK and Germany) responsible for close liaison with the design teams. These three also have other responsibilities within their national R&D organisations, where they are based.

12. The collaboration has increased the formality and complexity of the documentation systems for the management and description of the R&D work compared with the previous arrangements for the UK national programme. This has occurred partly to ensure misunderstandings over the allocation of responsibilities are avoided and also because the R&D organisations have retained control over the deployment of resources. Therefore it has been vital for each partner to be absolutely clear on the timescales specified by the designers for providing development data, which laboratory and technical specialist is responsible for each task, and that his senior management accepts the resource commitment involved in that responsibility. Also, before advice on an R&D matter is passed back to the designers it is necessary for the partners to agree that the advice is the best available at the time, based on the combined pool of experience. Endorsement procedures have therefore been introduced to indicate that all partners concur with the information being given.

The Committee's Questions

Advantages and Disadvantages

(i)

Practical Experience with Working Arrangements

13. Collaboration at all levels has undoubtedly been extremely successful. Advantages to the UK include:

- rationalisation of technical programmes with the partners. This has allowed the UK continued access to design and development data across the full range of technology, despite the cut of 80 per cent in the UK government's contribution to funding the R&D programme. (The February 1989 agreements were signed by our partners in full knowledge of the UK government position, but if the other major partners, France and Germany, were to reduce R&D funding by a similar amount, the support available to the design teams would no longer be viable.)
- access to a number of advanced facilities operated by partner organisations
- access to a wider range of design solutions for specific plant features than would have been possible with a single national programme, allowing selection of the best for EFR and future commercial projects
- the stimulation and morale boost to design and development teams through being part of a major international project
- experience gained from working in Europe on an advanced technical project. This should have a spin-off value for future business opportunities, particularly post-1992.
- exchange agreements on fast reactor technology with countries outside Europe such as Japan, Russia and the United States, which in the past have operated on a bilateral basis, are now increasingly being organised in conjunction with the European partners leading to savings nationally in travel and administration costs. At the same time the breadth of technical exchanges has tended to increase relative to the earlier bilateral arrangements.

14. The possible disadvantage from participating in this collaboration is that the UK is now strongly dependent on its partners for expertise in a large number of specialist areas, making a return to a "go it alone" policy, if ever that should be necessary, more difficult. Likewise the partners are dependent on the UK for work in a number of key areas, having closed down their own facilities. Withdrawal by any one of the main partners would therefore create difficulties for those remaining and could put the EFR project at risk.

15. The success of the collaboration has come mainly from the personal contacts made in working on joint topics. The cost of travel to international meetings or for short periods of overseas work is significant, but is necessary to gain the advantages of collaboration. Careful selection of high calibre staff is essential, together with the provision of the necessary conditions and communication facilities for their purposes. The mutual respect gained in those activities takes some years to develop, but once achieved transcends national boundaries and ensures good working relationships. Modern communication techniques have been used progressively to simplify working arrangements and minimise travel requirements as people have become used to working together.

16. In general, the collaboration has flourished because all parties have shown enthusiasm, adaptability and a great willingness to work together. This is a considerable achievement, especially considering the large number of R&D, design and electricity supply organisations interacting together, and needing to work in

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[Continued

a cohesive manner. No insuperable impediments have been identified from practices either within the UK or in partner countries, although overcoming different bureaucratic procedures on matters such as taxation can be time-consuming and frustrating.

(Question (iii) on Machinery is covered in Background, para 2 above).

Impediments

(viii)

Intellectual Property Rights

17. The importance of establishing clear ground rules to deal with Intellectual Property Rights was recognised at the outset of the collaboration, and an agreement has been signed between the AEA and NNC on the UK side and the equivalent R&D and design organisations in France and Germany. The French and German organisations had already put such an agreement in place between them to deal with their earlier collaboration on fast reactors.

Exchange of Staff

18. Relatively small numbers of staff have been involved in detached duty in France or Germany. The maximum at any one time has been about ten. The costs are high but are easily justified by the broader experience and access to other nations' facilities and expertise.

Impediments

(ix)

National Benefit and Protectionism

19. Concerns over national benefits and protectionist attitudes have not so far created any particular difficulties for the R&D collaboration. They may become more significant once there is a firm commitment to proceed with construction of the project, and there is international competition to win contracts for plant components.

20. At present there is undoubtedly still some rivalry between partners in certain technical areas, with each supporting their national preference. However, this rivalry is not unhealthy, leading to a keener assessment of the advantages and disadvantages of each. This assessment process eventually leads to a consensus, allowing rationalisation of further development effort and concentration on the preferred solution.

21. The aspect where rationalisation is proving most difficult is in the selection of reference computer codes to be used as aids to the design and to understanding the performance of a variety of plant features. Prior to the collaboration, each partner had developed its own theoretical codes for these purposes. In some technical areas versions of the codes are used more widely than merely for fast reactor purposes, and therefore "national" codes will be kept available. Each nation's codes tend to be more powerful in certain respects than their equivalents developed by the other partners. This leads to significant technical difficulty in deciding which are best suited overall for selection as the most appropriate for further development. Designers, operators and licensing authorities have become familiar with their national methodology, and are understandably reluctant to change. It is evident that success has been better in certain technical areas than others. It remains a priority objective to complete the process, but it is proving necessary to allow time to reach a consensus.

Funding Arrangements

22. Funding of the R&D programmes in support of EFR is primarily provided by government in the UK, France and Germany, whereas the design work is increasingly funded by the electricity utilities in their capacity as eventual customers.

23. Contributions to the funding of the R&D programme in 1990 are as follows:

	£Mpa
UK	10
France	29
Germany	34*
Total	73

(*includes small contributions to the programme from Belgium and Holland).

24. It has not been found possible to compare budgets precisely either in terms of financial expenditure or manpower deployment, because of different accountancy conventions adopted by the various organisations involved. The differences occur almost as much at organisation level as at national level, and therefore should not be seen as a problem peculiar to international scientific programmes. It is of course exacerbated by currency fluctuations, differences in the cost of living and salary variations.

25. It is clearly a matter of concern as to how long the other partners will continue to give the UK full access to development data in the light of our much lower funding contribution. At present the imbalance

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is partly offset with respect to Germany by the experience we can contribute from the operation of the Prototype Fast Reactor (PFR) at Dounreay. Although France also contributes operational experience from its own prototype reactor Phenix at Marcoule, and the larger commercial-scale plant Superphenix at Creys Malville, there is also a recognition in that country of the benefit of PFR to the project. This factor is likely to be lost to the UK after 31 March 1994 when the government funding for PFR will cease. AEA Technology is therefore trying to find alternative funding arrangements for extending the operation of PFR beyond that date.

26. With each R&D organisation retaining control of its own resources, there has so far been no common funding management arrangement. The collaboration has therefore operated on the basis of broad agreement reached annually by the Steering Committee, on future funding priorities and on which partner was best able to carry out work on specific topics. Funding pressures experienced by all partners, and recognition of the need to rationalise have ensured that this process has operated successfully. Nonetheless each partner sees the priorities for further development on the various reactor components and design features somewhat differently, in the light of national experience or questions raised by licensing authorities. These differences are recognised by the Steering Committee when considering resource allocations for future work.

Concluding Remarks

27. Collaboration with European partners on the development of fast reactors is proceeding very successfully. It has allowed substantial rationalisation leading to significant cost-savings for all partners, without a loss of impetus towards the objective of a commercially attractive design of fast reactors.

28. Rationalisation of an international programme of this nature is however unlikely ever to be perfect. National interests and preferences introduced for instance by licensing considerations mean that the total R&D programme will always be somewhat larger than any one of the partners would carry out on his own account.

29. Experience so far has been that there is willingness on all sides to find the "best" solutions, such that despite rivalries and national preferences a consensus as to the best solutions has usually emerged.

ANNEX B2

UK SAFEGUARDS R&D PROGRAMME (part of AEA Fuel Services)

The UK Safeguards R&D Programme has its origins in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) which requires non-nuclear weapon states party to the Treaty to negotiate and conclude an agreement with the IAEA on safeguards for the purpose of verifying fulfilment of obligations under the Treaty. The UK, a signatory to the Treaty as a nuclear weapons state, made a voluntary offer to the IAEA to place all civil nuclear facilities under safeguards.

2. In order to carry out its mandate to devise and apply a system of safeguards, the IAEA required appropriate techniques and methods to be developed. Rather than provide the Agency with the resources to carry out the necessary R&D, it was decided that this would be undertaken by member states through voluntary support programmes. HM Government, through the Department of Energy (DEn), announced in June 1980 that the UK were offering a programme of R&D in support of IAEA safeguards. Funds of £500K per annum were set aside for a three year period, together with a single amount of £130K for the provision of equipment to the Agency; this latter sum was subsequently used to provide a mass spectrometer on indefinite loan. The UKAEA were invited by DEn to manage the Safeguards R&D Programme which was formally set up in 1981. Since the initial three year period, the value of the Programme has approximately kept pace with inflation and it is now funded through a Programme Letter from DEn at about £1.0M per year. Most of the work is carried out by AEA staff but occasionally work is placed with sub-contractors within the UK.

3. In brief, the objectives of the Programme are to provide assistance in the field of safeguards to the IAEA and to create a body of technical experts who can provide advice to the Agency and HMG with full understanding of the UK position. The programme of work is agreed with the Agency and DEn at an annual Steering Committee meeting, the current emphasis being on safeguards for reprocessing plants and centrifuge enrichment plants. Other activities include studies of containment and surveillance measures, non-destructive techniques for the assay of nuclear materials in waste, preparation of standard reference materials for destructive analysis and authentication methods to enable the IAEA to make use of facility operators' computer systems. Another very important part of the Programme is devoted to the provision of services which the Agency are not able to obtain from commercial sources; these include training courses for safeguards inspectors and provision of consultants to carry out studies on important safeguards topics. The results of the Programme are normally published in unclassified reports.

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4. The UK Programme is one of about 14 such support programmes provided by member states. These programmes vary greatly in size, the US one being about as large as, and possibly larger than, all the rest put together. Each programme is independent, although co-operation through joint tasks occasionally takes place. Approximately every two years, the Agency hold a meeting of support programme co-ordinators at which details of the work being carried out in each programme are presented. The information obtained at these meetings, the distribution of reports to other member states and the co-ordinating effect of the IAEA at the centre of the support programme system are instrumental in avoiding duplication of effort. In addition, the AEA is a party to the European Safeguards R&D Association (ESARDA), through which information on safeguards R&D programmes in other European countries is obtained, thus further helping to avoid unnecessary duplication.

5. There is no formal commitment on the part of the UK to provide the Programme to the Agency for a specified duration. The AEA bids annually to DEn for funds to carry out the work and while there is a need for R&D in the field of safeguards, the continuation of the UK support programme is seen as a clear sign of the UK's political commitment to international safeguards.

ANNEX B3

AEA SAFETY AND RELIABILITY

Nuclear Safety

AEA's Safety and Reliability Directorate, now subsumed into the AEA Safety and Reliability business, has traditionally been the focus within AEA for international collaborative activities concerned with nuclear safety. These activities have included a number of bilateral exchange agreements with individual countries, notably the USA (USNRC) and France (CEA), and involvement in the work of multilateral bodies such as the CEC, NEA and IAEA.

2. Funding for these activities was provided by DEn through the General Nuclear Safety Research (GNSR) programme. From 1 April 1990 overall management of both the USNRC and CEA agreements was included in that part of the GNSR programme transferred to the HSC and managed on its behalf by HSE for which funding is now provided by the HSE levy on nuclear site licencees, and the responsibility now lies with the Thermal Reactor Services Business (see Annex B4).

3. Specific activities under the USNRC agreement have included:

- (a) the AEA pays for two attaches, one at Oak Ridge and one at Sandia National Laboratories;
- (b) a special agreement within the umbrella agreement provides £50K per annum to the National Centre of Systems Reliability to support work on human factors, dependent failures and software as required by USNRC;
- (c) a second special agreement, due to finish in September this year, allowed the USNRC to contribute £200K in return for access to the results of the CEGB's test of a scale model of the Sizewell B containment building.

4. Under the umbrella agreement with the CEA there have been specific agreements for work on external hazards and criticality. Neither of these involves cash payments.

5. £50K has been set aside this financial year 1990-91 under the Department of Energy funded GNSR programme for exploratory discussions with the USSR on collaborative activities in nuclear safety.

6. The CEC runs a number of Shared Cost Action research programmes. These are co-ordinated programmes of work in which individual items are carried out by laboratories in the different member states. As the name implies the work is part-funded by the CEC and part-funded by the home laboratory. We have had a number of such contracts on safety topics, the CEC funding generally being of the order £10K-£100K, the remaining funding being provided by the DEn Programme Letter (GNSR).

7. We have also participated in the International Peer Review Service run by the IAEA. This employs panels of experts from member countries to review the safety of reactor designs, including some in Eastern Europe and the USSR. The IAEA pays expenses, but staff time is paid for by the experts' own organisation (in this case via a Department of Energy Programme Letter). We have been involved with several studies to date, each requiring 1-5 man weeks of effort.

Non-Nuclear Safety

8. AEA Safety and Reliability has also been involved with a number of shared Cost Action contracts under CEC programmes in the non-nuclear safety field:

- (a) ESPRIT Projects—these are software projects carried out by consortia involving the AEA. They have been 50 per cent funded by the CEC but in none of these cases was the remaining 50 per cent provided from government funds.

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- (b) Projects under the Major Technological Hazards segment of the STEP programme. These are again 50 per cent funded by the CEC, the matching funds in this case coming from the HSE. All have a three-year life and are on-going.
 - (i) £200K (from the CEC) for a study of the Management of Risk, in collaboration with TNO of Holland;
 - (ii) £26K for a study of the effects of natural and man-made obstacles on heavy gas dispersion;
 - (iii) £26K for a study of the continuous release of liquefied gases from pipework failures, etc.

ANNEX B4

AEA THERMAL REACTOR SERVICES

1. In the field of Safety Research and Development relevant to thermal reactors AEA Technology has established a network of international contacts. These ensure awareness of work in other countries, avoid unnecessary duplication, and lead to a cost-effective approach through the stimulation of collaborations with specific objectives of mutual interest. These collaborations cover a wide range. They can be grouped into four categories as follows:

- (a) Participation in Technical Working Groups sponsored by the International Atomic Energy Agency (IAEA) or by the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD). The latter, in particular, has led to co-operative research projects in which each country bears its own costs in return for access to each other's data. (Examination of debris from the Three Mile Island reactor accident is a recent example.)
- (b) Joining international programmes, e.g., those sponsored by OECD. These usually require cash payments related to GNP. A recently completed example is the 10 nation LOFT programme which simulated eight reactor accidents of progressively increasing severity. The UK obtained access to data costing \$100M to acquire in return for a \$5M contribution.
- (c) Entering into bilateral agreements with organisations conducting safety research in other countries (notably in the USA, FRG, France and Japan). These have covered exchanges of data and staff or conduct of experiments on a cash basis (see Annex B3).
- (d) Bidding for contracts under CEC Joint Action Programmes. These have the effect of increasing the scope of work already planned as part of a UK programme and so increase the cost-effectiveness of a limited national budget.

2. Until 31 March 1990 government funding covering AEA participation in these international nuclear safety research programmes was provided by the Department of Energy. Where substantial expenditure was required they insisted that 49 per cent of the burden should be borne by NE/CEGB. As from 1 April 1990 sponsorship of these Nuclear Safety Research Programmes was transferred to the Health and Safety Commission and managed on its behalf by HSE. They have been given powers to levy the costs on the nuclear site licensees so no further burden will fall upon government funds in connection with International Scientific Programmes relating to the safety of thermal reactors. The Department of Energy will provide some limited funds to enable AEA to advise it on developments overseas and on the potential consequences of accidents in other countries.

ANNEX B5

AEA PETROLEUM SERVICES

AEA Petroleum Services are involved as agents of the Department of Energy in the following collaborative agreements:

- (a) With the US Department of Energy. This agreement involves the US providing us with technical data from field projects on enhanced oil recovery funded by the USDOE and carried out by oil companies. The UK Department of Energy places contracts with us to carry out detailed computer simulation studies using these data. This collaboration has now been going on for about five years and in terms of our effort costs some £30,000 a year. The benefit is that the UK computer codes are validated, using realistic data, and the US benefit is that they get access to analysis which they would not otherwise have. The UK Department of Energy effectively saves money by not having to finance its own pilot studies.
- (b) We are also agents of the Department of Energy in representing it at the International Energy Agency Committee on Enhanced Oil Recovery for which we provide the current chairman. In this we have to dedicate the results from a university project sponsored by the Department to the project. The benefit of putting in a project is that information on about ten other projects from other countries is obtained. The cost of this is in the order of £20,000 a year.
- (c) We also collaborate on behalf of the Department of Energy with the Norwegian Petroleum Directorate. We discuss the UK DEN enhanced oil recovery research programme with the Norwegians who give us information on their SPOR enhanced oil recovery programmes. The benefit here is that we get access to a different perspective on techniques.

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ANNEX B6

AEA ENVIRONMENT AND ENERGY

International Programmes

There are several Environment and Energy international scientific programmes which are part-funded by UK Government Departments. Most fall into the air pollution modelling area. All are part-funded by the CEC (usually at the 50 per cent level but this is not always the case). Examples of such projects are:

- (a) Influence of Atlantic air masses on oxidation processes
- (b) Laboratory study of peroxy radical reactions of importance for tropospheric chemistry
- (c) Atmospheric degradation of volatile organic compounds
- (d) Atmospheric degradation of alternatives to CFCs
- (e) Halogen oxide reactions of importance for the lower stratosphere
- (f) Assessment of internal dose of radionuclides using stable isotope tracer techniques
- (g) Spectral and angular radiation studies

Contract values range from about £30K to about £300K and durations are one to two years. Projects (a) to (e) above are part-funded by the Department of the Environment, (f) by the Department of Health and (g) under the Department of Energy programme letter for radiological protection research.

Responses to Committee Questions

2. We have the following comments on the nine points raised in the letter of 8 June from the Clerk of the Select Committee:

Advantages and Disadvantages of joining ISPs

(i)

Many of the issues addressed are problems which exist on a global scale. The UK can be seen to be contributing financially to research on projects which address global environmental problems, and the participating laboratory gains an international reputation in such fields.

Hosting Large Facilities

(ii)

Not applicable.

Machinery

(iii)

The relevant UK Government Departments have been aware of the remit of the corresponding CEC programmes and have organised their resources accordingly. The opportunity exists to spread limited resources for maximum effect.

Technical and Financial Criteria

(iv)

The CEC publish their technical and financial criteria at the time of issuing the request for proposals. Generally, it has been possible to match the UK Government Department criteria.

Forums

(v)

It is frequently our staff who approach the relevant Government Department to determine whether or not part-funding fits in with the Project Officer's plans.

Government Practice

(vi)

We are not sure that Government Departments distinguish between ISPs and cost-shared contracts. Most Departments with which we have contact appear to have formulated policies, and there are some differences between Departments on the practices followed, e.g., on allowable costs.

Treasury Rules

(vii)

No comment.

Impediments in UK

(viii)

We feel that the main impediments are practical problems, e.g., one cost-sharing body makes a decision to allocate funding whilst the other remains undecided. This leads to budget phasing difficulties. In addition UK Government Departments in general have been more restrictive than the CEC in their policy concerning dissemination of the results of our international programmes.

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Impediments Outside UK

(ix)

Since all our experience involves CEC collaboration, the main impediment to non-EEC countries is the restriction of participation to organisations based in the EEC (or in some cases EFTA countries). Generally, our projects have sought to increase understanding in the scientific community of global scale problems, so commercial secrecy and intellectual property rights have assumed low significance.

ANNEX B7

AEA DECOMMISSIONING & RADWASTE

AEA Decommissioning & Radwaste's major involvement with Europe R&D is through the Windscale Advanced Gas Cooled Reactor (WAGR) Demonstration Project.

2. WAGR, the prototype of the commercial AGRs now in use in the UK, operated from 1963 until its closure in 1981. Following the closure AEA, supported by the Department of Energy, decided to undertake the development of the techniques required to enable WAGR to be decommissioned to Stage 3, a "green field" site as a demonstration that this could be achieved at reasonable cost even on a timescale which took only limited advantage of the benefits of radioactive decay. Following an assessment of the various alternative decommissioning strategies, the strategy finally adopted was that of a dismantling machine and robot mounted above the reactor pressure vessel at pile cap floor level.

3. Initially the decommissioning programme was funded only by the Department of Energy. From 1986 the CEGB funded approximately half of the project requirements of £5 million per annum, but this support was withdrawn at the end of 1987-88 financial year, during the early stages of ESI privatisation. From 1986 onwards, funding for particular aspects of the WAGR work received support from the CEC with matching funds being made available from the Department of Energy. Two work packages in particular are of interest:

- (a) The definition of the ventilation requirements of WAGR during the remote cutting operations, and
- (b) the decontamination of one of the heat exchangers to permit hands-on work.

Both these packages have been successfully completed with CEC support; in the first we worked in collaboration with CEA (France).

4. More recently the CEC has enlarged its decommissioning programme to support four major demonstration projects in Europe, one each in Belgium, France, Germany and the UK. The UK project is WAGR and the CEC are contributing around £700K per year to support an agreed programme of work for the next three years. The experience gained from these projects will be made available to all Member States in the Community to enable us to determine the most economic methods to be employed in decommissioning redundant nuclear facilities. This is achieved by regular reporting to the CEC Project Managers, together with the presentation of papers at CEC-arranged symposia. The first symposium on the major projects is arranged for autumn 1990.

5. The CEC funding only meets part of the WAGR project requirements, with the additional funding coming from the Department of Energy through the Decommissioning and Radioactive Waste Management Operations Programme Letter. Significant advantage is seen to the UK nuclear industry in participating in such projects as the means of optimising our own development programmes and in particular gaining access to the particular skills, e.g., of the French in robotics and the experience of the French and Germans in the decontamination and cutting up of contaminated/activated concretes.

Examination of Witnesses

DR B L EYRE, Chief Executive and Deputy Chairman, MR J R BRETHERTON, Secretary and Commercial and Planning Director, DR R BULLOUGH, Chief Scientist and Director of Corporate Research, AEA Technology, called in and examined.

Chairman

434. Dr Eyre, we are very grateful to you and your colleagues for coming along and giving evidence this afternoon and we are grateful also for the very comprehensive paper that you submitted to us which covers a wide field. You can see who we all are if you do not know already. I do not think there is any need to introduce our specialist assistants who are very well known to you, Professor Roger

Williams and Dr Mick Lomer. If you would like to introduce yourselves and make any statement in amplification of your paper, you may.

(Dr Eyre) Thank you, my Lord Chairman. If I could introduce my colleagues first. On my left is Mr James Bretherton, who is the Authority's Secretary and who also has special responsibility for many of the interactions we have with government departments and particularly the Department of Energy. On my right is Dr Ronald Bullough who is the

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[Continued

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Authority's Chief Scientist and who has responsibility for the management of all of our corporate research investment research type programmes. If I could say a word or two in introduction. I think, as you well know, the AEA has traditionally had a strong basic science component to its programme and that did involve us in active international links on quite a wide scale. That has tended to diminish in recent years. I shall just enlarge on that a little. I think that again you will know that since 1986 we have operated as a Trading Fund. Before that we were vote funded and were able to carry out our functions under the AEA Act of 1954 with a degree of independence to take initiatives—for example, in participation in overseas programmes. Now we are a trading fund. We trade under the name of AEA Technology and although we still have a role of advising government and our legal powers are unchanged, we are now essentially more of an R&D and technology services contractor and therefore much more responsive to customer wishes and a lot of the responses, I suspect, to the questions we face today will be bringing that element into it. To that effect from the beginning of this financial year, we went through a further substantial re-organisation of the way we run our business and we now operate as a series of distinct businesses covering both nuclear and non-nuclear areas and part of the remit of these businesses is, in fact, to secure funding from overseas customers and we still do take an active part in international collaborative programmes. I think the two most notable ones are fusion and the fast reactor but also in the area of thermal reactor safety and we are involved in a number of European Commission programmes on both nuclear and non-nuclear topics. I think the key thing is we now operate much more as a commercial enterprise and therefore our involvement in overseas collaborations is linked to customer requirements and is customer operated and customer driven. My Lord Chairman, that sets the background to the way we operate now.

435. Thank you very much. You are involved in a number of different international programmes in different ways, as you yourself have said, in different agencies. Would you like to make any comparison between the different ways of operating, for instance, within a European framework programme or under EURATOM or under IAEA and the advantages and disadvantages of the different ways of doing it?

(Dr Eyre) I think our two major international programmes provide quite a nice contrast in that respect. On the one hand in the fast reactor programme we are part of the European collaboration but that is outside the European Commission programme. It is a direct inter-action with France and Germany as the principal partners. Some other countries are involved to a much lesser extent. So there are just the three main partners and each of the member countries decide how much they are going to contribute and then we collaborate and interact and carry out the programme in a strongly interactive way. I must say that it has worked very

well. The fast reactor programme in Europe I consider to be a considerable success and shows how an international collaborative programme can work and I do believe this country benefits very considerably from that European collaboration. Indeed it is not possible for me to see how we could take fast reactor technology through to commercial exploitation other than through that close collaboration. Our funding is provided by the Department of Energy in that collaboration. The fusion programme is a Commission programme. It involves, therefore, a much larger number of countries within the European Community and we get a mixture of funding, some directly from government and some through the Commission through a formula by which the Commission "tops up" national programmes. I think again that the fusion programme does work remarkably well in Europe and I think it is probably best illustrated by the JET project at Culham, which by any standards has been an extremely successful international project but there are many more complications in getting things done; in getting the programmes off the ground initially (sometimes several years because of the political situation) and the decision-making process in making new steps in the programme is that much more complicated the more countries you have involved and the fact you have got the Commission involved as well.

436. Could we go back to the fast reactor programme. Could you say how it was, in fact, set up and who took the initiative and what the method was for setting it up because you quoted it as being a particularly good example of how to set one up.

(Dr Eyre) Each of the major countries had their own national programmes for many many years. We have carried out research entirely as a national programme on fast reactors from the fifties onwards, as did the French. I cannot remember exactly when the Germans started their programme but certainly it was well-established. We came together first in the eighties and the French and Germans, I believe, had come together first and then we joined in with the European programme in 1984 when we signed a Memorandum of Understanding. That then led to the three countries working more closely together and that culminated last year in a more formal series of agreements being signed which covered R&D, the design, particularly of the European fast reactor project, and intellectual property rights. So from 1989, in fact, we are bound together by agreements that have been endorsed by our governments.

437. So there were no other agencies involved? It was initially Franco-German, which we joined?

(Dr Eyre) Yes. The Commission has not really played any direct part in bringing that collaboration together.

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438. Can I follow your question up and carry it a bit further. That, of course, started long before you were operating as a commercial enterprise. As of today could you explain to us where the decision-making lies in relation to international projects? To what extent does it lie with you as a commercial enterprise, to what extent does it lie with the Department of Energy, your sponsoring department, or to what extent does it lie with another department which may be involved in the international programme?

(*Dr Eyre*) As I said at the outset, Lord Nelson, we now operate as a commercial enterprise and, therefore, to a very considerable extent all of the things that we do are determined by our customers. In the case of the fast reactor the main customer is the Department of Energy and they, therefore, play a major role in determining the scope of our programme and the way in which we can interact with Europe. At the detailed technical level the AEA still plays very much a lead role in those decisions. We are members of the European R&D Steering Committee. In fact, our fast reactor Chief Executive is currently Chairman of that committee. Then there is a whole series of working committees covering all the different aspects of the technology and we have members on all those committees. That is where the technical details of the programme are determined but the funding within which we have to work is determined by the customer and our customer determines the scope of the programme and what we are doing.

Lord Taylor of Blackburn

439. Could I ask how your colleagues in France and Germany are paid? How are they funded?

(*Dr Eyre*) I think in the R&D programme, by the respective governments. There is a difference on the design side. As the fast reactor programme has moved from essentially an R&D project into a project aimed at a commercial fast reactor, we now have a European design team and Britain has a third share of that design team through NNC. In that case the design work is funded by the utilities in Britain and France, that is, Nuclear Electric now and EDF in France, and most recently the German utilities have agreed to fund their design team, so that the design work is funded by the utilities and the R&D part of the programme is essentially funded by the respective national governments. I think that is right without checking the facts.

440. Are there any restraints put on you because you are an agency now in comparison with what you were, say, 12 or 18 months ago?

(*Dr Eyre*) No, apart from the reduction in the size of our programme, which has clearly changed the nature of the UK programme. I do not think that our moving to a more commercial operation over the last 12 to 18 months has changed the basic decision-making on the programme within the AEA.

Lord Flowers

441. My memory is rather bad but I seem to remember that round about 1980, maybe a bit before, there was the possibility that you would engage in the collaborative fast reactor programme with the Americans as an alternative to doing it with France and Germany and I know the argument went on for some considerable time and that people took rather stronger personal views about the matter than perhaps they should have done—human nature, no doubt! What I wanted to ask you was, do you think that the fact that there were two alternatives co-existing for quite some time helped to give the impression that we were not particularly keen to collaborate on a European project or not keen perhaps on fast reactor development at all, and do you think it might have been wiser with hindsight if the Government had given some sort of steer about with whom collaboration should be?

(*Dr Eyre*) That covers a number of issues and it is quite a difficult question to answer. It actually goes back before my detailed involvement in the programme but certainly the UKAEA traditionally had a strong interaction on fast reactors with the Americans right through the 1960s and 1970s. This link goes right back to the start of the civil nuclear power programme. We used to have strong technical interactions with the Americans through the Libby-Cockcroft meetings, for example, in which I took part. For example, we carried out irradiation programmes in PFR for America, so I think that strong link with the United States did inhibit our involvement with the Europeans. We did not look to Europe, we looked to America for our collaboration. If my memory serves me right, I would say one of the key turning points was, in fact, the change in American policy towards fast reactors during the Carter Presidency when they turned their backs on reprocessing. Then, of course, their whole strategy for fast reactors for a while started to fall apart until they rebuilt it. They have a strategy now but I think that was a key factor in our disengaging from the Americans and working more with the Europeans. The role that personalities played in that I really cannot comment on. I know that these things always do play a role but I think it was the change in American policy as much as anything that caused a change in direction for the UK programme to look from across the Atlantic to across the Channel.

Lord Sherfield

442. To what extent does the threatened closure of Dounreay in three or four years' time affect the value and the whole form of our collaboration in the European programme?

(*Dr Eyre*) I have to say that our view in the AEA is that it would have a serious and deleterious effect. Our European partners are disappointed that the PFR is being closed in 1994. The French and the Germans were hoping that the UK would keep that prototype reactor going. It still has a valuable technical contribution to make in a number of

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[Continued

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directions and, of course, when the PFR closes the UK programme funding, at least on present projections, will be very much less than that of our partners. Our programme will decrease to a £10 million a year core R&D programme and if our partners, the French and the Germans, came down to that level then it is my belief that it would be difficult to sustain and underpin the European fast reactor design, and that is the view of all the partners.

443. Obviously the Dounreay reactor is extremely valuable as a test bed, particularly for fuel elements. Will there be any substitute for that as a research facility after it has closed down?

(*Dr Eyre*) Within Europe there are currently three fast reactors operating, two of them in France, that is, the Phenix, which is a similar size to PFR and is a prototype reactor, and Superphenix, which was intended to be a demonstration prototype reactor. The Germans look as though they will not be able to start the operation of SNR 300, which would have given us a third reactor.

So when the PFR closes down we will essentially be entirely dependent on the French reactors and particularly Phenix because Superphenix is really not suitable as an experimental test bed. The worry we all have, and the French say this themselves, is that Phenix has been operating since 1973. It has been operating at a higher load factor than PFR and there is, therefore, no certainty that we will be able to keep that reactor going through the nineties and up until the time when EFR construction is starting and well under way. I think the first concern, when PFR closes, is that we will be very vulnerable in Europe with only one rather old prototype reactor.

444. The closure of PFR might endanger the whole programme?

(*Dr Eyre*) In that respect, I would have to say yes.

Lord Flowers

445. Have the views of our European partners been fully taken into account in deciding to close PFR?

(*Dr Eyre*) I think that question is best directed at the Department of Energy witnesses as to how the decision was made. It is my understanding that our European partners were fully consulted.

Chairman

446. Is this really what you were referring to in your paper when you referred to "pulling our weight" in collaborative projects or are there other projects where we are not pulling our weight and ought to be? Perhaps you would like to give some examples.

(*Dr Eyre*) The fast reactor is one where we are moving to a situation where that is certainly a worry. I think also in the fusion programme the UK spend is now significantly less than that of the Germans,

French and Italians and whether that reflects another area where we are not pulling our weight, certainly our contribution is significantly less than the other major European countries.

Lord Flowers

447. Could I find out what you mean by not "pulling our weight". Is it the amount of money we have got to spend, which admittedly is not as much as you would like, or is it a question of the degree of enthusiasm shown for collaboration?

(*Dr Eyre*) In the fast reactor programme the thing comes much more sharply into focus because we are working towards a project objective there and we have got enormous benefits that have come out of European collaboration. There has been an enormous exercise in rationalising facilities and teams and sharing tasks and some countries have given up facilities and rely on another country taking that part of the programme. It has happened to a remarkable degree in the fast reactor programme and I must say it is one of the most heartening aspects of the whole collaboration. Of course, if you are putting far less into the joint programme than your partners then you are able to carry out a much smaller share of the programme and to that extent you can be regarded as not pulling the same weight.

448. You are really talking about money?

(*Dr Eyre*) Yes but the money translates into an actual technical contribution and the technical contribution is directly proportional to the funding.

Chairman

449. That does not apply to the European framework programmes where the monies were fixed?

(*Dr Eyre*) The fusion programme is part of the framework programme, of course, and of that £100 or so million is provided by the Commission and the rest is then provided from national budgets into the contracts of association and the level of our funding is considerably less than the other major European countries, as I said earlier.

450. When the framework programme is being worked out, to what extent are you directly involved in the discussions that take place or is this entirely done by the Department of Energy?

(*Dr Eyre*) In the case of the fusion programme, of course, we are very much part of the discussions that lead up to the framework proposal. The framework proposal is put together by the Commission and then submitted to the Council of Ministers and the Commission acts on advice from a whole range of technical committees and we do take part in some of these discussions.

451. There is direct consultation between the Commission and yourself?

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[Continued

[Chairman Contd]

(Dr Eyre) Yes, particularly in the fusion programme certainly. I do not know if Mr Bretherton would like to take that one up?

(Mr Bretherton) We are certainly represented on a number of technical committees but at the end of the day it is the Department who decides what is the UK contribution to the contract of association programme.

452. Do you detect any discrepancies between the priorities within the European framework, the priorities set by the Commission and the priorities that the Department of Energy themselves have which causes you any problems?

(Mr Bretherton) Certainly there is a problem in the sense that the role of the fusion programme and the importance of the fusion programme is not viewed in the same way in the Department as it is in Brussels.

453. You reckon that Brussels attach greater importance to it than the Department of Energy?

(Mr Bretherton) There is no doubt about that.

Lord Sherfield

454. Leading on from that, I notice that in the passage on Treasury attribution at A 18, you say: "This policy is applied inflexibly to all programme proposals irrespective of scientific and technological merit or to the contribution the UK scientific community might have to offer. It has created, not surprisingly, an atmosphere of suspicion and hostility amongst our European partners." That is something that I have long suspected but has never been so clearly brought out. Could you perhaps elaborate on that?

(Mr Bretherton) That is our impression. I do not think anybody else in Europe operates a system in quite this way. In a sense one cannot elaborate as again this is a question you ought to pose to those who are following us. There is no doubt that our partners are dissatisfied with the way the mechanism works, that it does not give an impression that we are really behind the programmes that the Commission is proposing or funding to the same extent as our European colleagues and that we appear to be dragging our feet.

Lord Nelson of Stafford

455. Could I be clear. You are operating on a commercial basis. To what extent do you take the initiative yourself and seek out work on a collaborative basis on an international basis by going out and looking at various proposals and ideas and generating your own ideas and then by then those to the relevant departments who are going to put up the cash. Or are you adopting a purely passive role and playing your part when somebody in one of the departments says, "Please will you participate in this programme?"

(Dr Eyre) No we do not, my Lord, play a passive role in this. We do still play a pro-active role in seeking international collaboration and participation in international programmes where that seems sensible but we cannot then go ahead and enter into commitments into these international collaborations and interactions without first identifying a customer who we then persuade to provide the funding and it could be a government department or it might be one of our other customers.

456. You may have to do just as big a selling job on one of our departments as on the foreign partner?

(Dr Eyre) Yes, as I say it is not just government departments. In the nuclear safety area our inter-action is essentially with HSE, Nuclear Electric and Scottish Nuclear. But the plain realities are we have not got funding of our own. It is not absolutely black and white. I will ask Dr Bullough to comment on this in a second but generally we do not have funding of our own such that we can just set up international programmes on our own initiative. We have to go back and persuade a customer that this is a good idea and that they will get benefits from it and therefore they should help to fund it but we do actually take the lead in trying to identify such opportunities.

Chairman

457. Could you actually get a contract from another nation?

(Dr Eyre) Yes.

458. To meet a framework programme, for instance?

(Dr Eyre) No.

459. Not for a framework programme?

(Dr Eyre) No.

460. But for international collaboration you could get a contract?

(Dr Eyre) In principle we can and, of course, a very important part of our strategy now is to get more support from overseas and there may be jointly funded programmes which would involve overseas countries that might involve participation in international collaboration.

461. Are there any particular difficulties with this because of your security status?

(Dr Eyre) I would say not in general, my Lord Chairman.

Lord Flowers

462. I sometimes get the impression that we go into a fairly large-scale project on our own and then later on, when times get harder, we say we must have international collaboration to pay for this project

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[Continued

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and, as I say, we try to drag other countries into it, but, of course, it would have been more sensible had we started off by saying, "What about it? It is a good idea. Would you like to join in right at the beginning?" This again gives an impression of unwillingness to collaborate until we are forced into the position through financial pressures. Are some of the things you were saying consistent with that interpretation? Perhaps you do not think what I have said is fair?

(*Dr Eyre*) I think it is very difficult to make a judgement. If you take the fast reactor programme in particular, where we are fully involved in the European collaboration, I believe we are getting very considerable benefits from that. Even with our reduced programme there are very considerable benefits to the United Kingdom, but when we started out in fast reactor technology in the late 1950s and carried it through to the early 1960s there was not a spirit of international collaboration in that area anywhere. The French were doing their own work, the Americans were doing their own work and it was not until we got into the 1970s that the French and the Germans started getting together. We were interacting with the Americans but not actually in a collaborative sense. We had information exchanges but were not working jointly to a common goal. I think it is very difficult at the beginning of a project to see whether international collaboration is the right way to go. In general when you get these projects such as the fast reactor and such as fusion it often becomes generally accepted that it is very sensible. I hope the fusion programme will actually go more international than just European. I think it does make a lot of sense when the project gets to that stage but it is very difficult to foresee it when you are actually starting out on this road.

Chairman

463. Are there any problems with including other countries? You have Sweden and Switzerland involved. Does that raise particular problems if there are countries taking part which are not actually within the Community?

(*Dr Eyre*) In principle not at all, no. In fact, we are also having discussions about the Canadians coming into the European fusion programme, so that it appears that there are no difficulties there at all. I do not know whether again Mr Bretherton has anything he would like to say on that.

(*Mr Bretherton*) Not actually on that but could I add a point on the previous discussion. I think the difficulty about international collaboration arises where policy attitudes change. There is no doubt that the attitude of the British Government towards the funding of research expenditure has become much harsher over the years. Therefore what we are seeing, both in the fast reactor area and in the fusion area, is an unwillingness to maintain the sort of commitment that was originally envisaged and that does make it very difficult.

464. In many ways you prefer something like CERN, where it is almost impossible to get out?

(*Dr Eyre*) I think there is a point there and that is that the fast reactor programme perhaps would be better if there were a central pot of money that was distributed to the different research groups rather than each pooling its national programme. That would be the next step to take.

465. So that it would turn into a more international programme?

(*Dr Eyre*) Yes, with a common management and common direction of the programmes that applies to all the countries.

Lord Sherfield

466. More like the European Space Agency? Are you talking in those terms?

(*Dr Eyre*) Yes. I am not familiar with exactly how the ESA works but if that is how it works, yes.

Chairman

467. Have the benefits and advantages of hosting JET been objectively looked at? I do not just mean the scientific and technological benefits but in this argument about whether it is a good thing or not a good thing to host a major project. Has somebody done a thorough survey, including the advantages in terms of local employment—the whole field really?

(*Dr Eyre*) Yes, we have made some estimates and assessments of the other benefits that have come from hosting the JET programme. Some of the advantages are that 50 per cent. of the contracts and money associated with JET have been awarded to the United Kingdom. There is a £75 million annual spend on JET, of which 65 per cent. is spent in the United Kingdom. We have attracted a multinational team to JET, so that it is quite a considerable sized team, and they live in the Oxfordshire area and benefit the community in all sorts of ways, including spending money, including culturally, and there is a European school there. So there are a number of indirect financial benefits that have come from having the JET project at Culham. The disadvantage we have is that, of course, we pay a larger sum towards JET than the other countries. We pay 10 per cent. of the premium, the Commission pays 80 per cent. and the other 10 per cent. is then shared between the other contract of association countries, but there are very considerable financial benefits from having a project of that sort sited in this country.

468. On the other hand, of course, if you wish to make a major change in policy you cannot because you have the whole thing left on your hands?

(*Dr Eyre*) Yes. In agreeing to host a major experiment of that sort there are commitments involved and, of course, that is a very important part of the debate that is going on currently.

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[Continued

Lord Sherfield

469. There is a suggestion in your paper, I think, that the JET project may be extended by up to four years. How does that stand?

(*Dr Eyre*) Discussions are still under way on that and again I think the Department of Energy witnesses will be able to enlarge on that. I think the feeling is that it seems more likely that the project will be extended to 1996 but the final decisions have yet to be reached.

Chairman

470. Are there any lessons to be learnt from JET which could be applied to other international scientific programmes?

(*Dr Eyre*) Yes, I think there are a number of points, my Lord Chairman, if I can try and go through them. Firstly, the political problems of getting a major project of that sort under way are very considerable and that was very apparent in the difficulties of trying to reach key decisions during the 1970s.

471. Political difficulties just in getting a decision?

(*Dr Eyre*) Yes. You are trying to get eight or nine, or whatever the number of countries is, to come to a common view and it is a major investment, so that it is a decision on both siting and financial commitment. Having got the project started, then it is very clear—and this is a strong lesson from the JET project—that you need clear project definition and you need definition of objectives and very good project leadership, which the JET project had, both through Hans Wurster and subsequently Paul Rebut, and also the quality of staff. You need to have the commitment of all the member countries to send high-quality staff to the project. Again the JET programme reflects that. The contract of association countries have sent very good staff. Finally, it must have the full support of the host laboratory and there has been a very good interaction between the AEA's Culham laboratory and the JET project and the JET team. So you need all those ingredients and JET, by any standards, has been an extremely successful international experiment and a remarkable achievement. It was built more or less to time and to budget and the technical achievements of the machine after it has been commissioned have exceeded people's expectations.

472. We have been talking entirely about major top-down projects. Are you involved in any way in bottom-up projects for international collaboration?

(*Dr Eyre*) I think on a much smaller scale, particularly in the non-nuclear field and perhaps Dr Bullough could say a few words about non-nuclear international projects we are involved in.

(*Dr Bullough*) My Lord, we have involvements to the extent of almost £3 million in the framework programme within its non-nuclear components,

largely determined by ourselves, ESPRIT, BRITE, EUREKA, ESPRIT II etc. On the whole we find these relationships in which we normally take the initiative, very satisfactory. I can elaborate if you wish.

473. They would have been initiated and the idea for cooperation would have emanated out of your own laboratories?

(*Dr Bullough*) Yes, it is quite different from the nuclear side.

474. You are happy with the procedure? That works alright and is not subject to great delays?

(*Dr Bullough*) There is a degree of bureaucracy, of course, in Brussels, but we have over the years established a presence there on the various working parties and committees that ensures what I think is most important, that we get some awareness of any future initiatives. This is part of our policy, to try and get an inside view of the thinking of officials. We perceive all kinds of advantages in establishing relationships with companies and universities throughout Europe. The down-side, of course, involves issues like sharing intellectual property rights.

Lord Flowers

475. Could I pursue that. In university life, as I am sure you are aware, international collaboration very often takes place just by two or more people meeting at conferences or wherever and finding they have a common interest and doing things jointly is better than separately and something starts. And I think this perhaps is what the Chairman means by "bottom up". Does that happen with you or really does it only happen under pre-conceived and somewhat planned programmes.

(*Dr Bullough*) It has to be done within the scope of one of the various initiatives otherwise the officials would not look at the proposal.

476. There is not much room for spontaneity?

(*Dr Bullough*) You can be spontaneous within a defined envelope! The quality of the product depends on your choice of associates.

(*Dr Eyre*) If I could perhaps interject there, my Lord. That was very much more the philosophy of the AEA in the old days, if you like, when we had a large basic research programme particularly at Harwell. Both Dr Bullough and myself ran basic research groups at Harwell for many years with two or three overseas scientists working together with the home team and I could do that completely on my own initiative. Perhaps one or two people or perhaps a small group would come to work on a project. I think that is certainly one of the things, if it has not disappeared altogether, which has certainly declined considerably because of the constraints we face in having to be a customer driven-organisation. It is just one of the plain facts of life.

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[Continued

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477. It is organisational rather than penny pinching?

(Dr Eyre) If I can put it this way—it is the mechanism of funding. We do not have the freedom to set up things up on our own initiative because we do not have the funding to do this as we had in former days.

Chairman

478. Have you got restrictions also on cooperation by actually employing or exchange of scientists from other nations.

(Dr Eyre) No my Lord Chairman, not in principle. In fact, we do have foreign scientists and engineers coming and working with the AEA. We have a number through the European collaboration programmes on fast reactor and fusion but even outside that we might undertake to accept foreign scientists on training, for example, from less developed countries but we have got to identify a source of funding for it very specifically and that generally means having a customer somewhere that is prepared to support it.

479. Dr Bullough just mentioned intellectual property rights. Could you expand on that and say if there are difficulties over intellectual property rights in this international collaboration.

(Dr Bullough) It is not so worrying in the smaller collaborations. If a valuable invention seems likely in a particular field then sometimes we can fund the work ourselves; then the result can be contributed to a collaboration without giving away all the details of their production. That is the kind of thing one has to be careful about so I think great care and sensible contract negotiation is the right answer to your question. We are investing in all these exercises now to make an eventual business opportunity evolve and therefore if an arrangement is successful on ESPRIT, for example, we would usually pair off with one of the partners to exploit the situation, usually including our intellectual property rights, which we have carefully guarded, as our contribution.

Lord Kirkwood

480. In your research contracts that you arrange, do you not automatically put something like a 10 per cent surcharge on your costs on the Rothschild principle in order to build up a little reserve to fund small projects and invite foreign scientists across in the way that was done in the past?

(Dr Eyre) If I can try to answer that, my Lord. How we do that now is that we include an element in the price. It is not a fixed amount. We are very much more in the market, particularly in our non-government programmes, of charging what the market will bear but we do make a provision for what we call “investment research”—on 5 year timescales and some shorter-term timescales aimed at getting new business opportunities up and

running rather quickly. Dr Bullough manages both these areas. We currently invest 5 or 6 per cent of our turnover in activities of that sort. We do not put in an identifiable levy as such in the way that we have done in the past but there is an element in our present structure which is to cover future investment research. I turn to Mr Bretherton.

(Mr Bretherton) That is correct, yes.

Lord Nelson of Stafford

481. You refer in your report to the importance of the exchange of personnel, which I think is extremely important. Are there restrictions or inhibitions in sending personnel to work in these collaborative programmes in foreign laboratories and so forth? Equally could I ask if you have a deliberate policy of sending personnel to work in foreign laboratories in order to extend or broaden their experience and range of contacts and ability.

(Dr Eyre) I would not say we have a clearly defined policy but in a number of collaborative programmes we are involved in, they involve the exchange of technical personnel which is part and parcel of the collaborative programme. In the fast reactor programme we have various of the European scientists who will spend time at UK labs and our people will spend time in Europe and that, in fact, has become an increasingly important aspect as we have rationalised the programme. For example, in a key technical area, core mechanisms of fast reactors, the UK has the lead position in that technical area in Europe and we have the only major facility to work in that field so we have French and German scientists coming and taking part in experiments at Risley. Similarly we go to Caderache and to the German facilities and do work there. Where it starts to get difficult is where scientists want to come and work with us who are outside the collaboration. We have been involved in discussions recently about scientific interactions with Korea on fast reactors. If they want to send some of their scientists and engineers to our laboratories it does pose problems because we have got to be able to protect the data that we are producing in our laboratories which is the property of the European collaboration. If it was leaking to Japan or Korea or China we would have problems with our partners. There is a constraint in that sense.

482. Are we missing a trick or two in not using these international collaboration programmes for a process of educating and broadening the knowledge and experience of our own engineers which is the end result of greater personal contact and lots more international cooperation?

I think there ought to be a deliberate policy. That is really the question, I feel.

(Mr Bretherton) I wanted to add that we should draw attention to the JET project at Culham, which is an example of a multinational team operating very successfully in the United Kingdom and, therefore, there is a lot of exchange of experience going on in

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[Continued

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that arena. There is a particular problem at JET that we should not deny exists and that is that our people are working on the JET project work on our salaries whereas the Commission people work on Commission salaries, which are very much higher, consequently you get different people doing the same job who are paid markedly different salaries and that has produced a certain amount of unhappiness. If one were to have another project that problem would have to be addressed. It is not always done that way in other parts of the world.

Chairman

483. Is there some sort of optimum number of different nations co-operating? The smaller the number, the easier it is to draw up a programme? Is there some number that over five it becomes very difficult—is two ideal and does more just cause trouble, or does it just depend on the project?

(*Dr Eyre*) My Lord Chairman, I do not think I can give a specific number but one of the essential ingredients of a successful interaction—and this goes back to when you are even doing basic science of the sort to which Lord Flowers was referring a few moments ago—is a common interest and common objectives. That is the absolutely key ingredient of

all successful collaborations. That is why the fact reactor collaboration works so well. The technical teams from the three countries that are involved in the fast reactor programme have a clear common objective and it is a very well focused programme. Of course, the more countries you bring in, the more difficult it is to define those common objectives and to that extent as the numbers go up it does get more difficult. I do not know whether there is an optimum number. Certainly three to five I think is quite manageable; once you get much above that it gets increasingly difficult.

(*Dr Bullough*) I think it is often important to bring in certain nations, particularly minority nations, to ensure a proposal is successful. So to that extent the national contest of the ensemble of universities or companies you involve, is rather critical. The first stage of assessing a proposal is very fair, with appropriate industrialists, consultants and academics chosen internationally for adjudication, but the second stage can involve a degree of unfairness if you have not included an “under-developed” nation.

Chairman] Dr Eyre, thank you very much indeed, that is very helpful to us. May I thank you and your colleagues very much for coming.

*15 November 1990]**[Continued]***Memorandum by the Department of Energy****INTRODUCTION**

1. The Department supports energy research, development and demonstration (RD&D) activities to further its general Departmental policy objectives. To this end the Department's objectives are:

- to support work which would not otherwise be undertaken on an appropriate timescale or to an extent commensurate with current and future UK needs in order to: contribute to the maximum safe, environmentally acceptable economic exploitation of the energy resources available to the UK both now and in the future; establish and develop economic options for safe, secure, environmentally acceptable and efficient energy supply, distribution and use for the future; enable the Department to carry out its statutory and regulatory responsibilities;
- to encourage UK industry and commerce to develop, for the domestic and export market, capabilities, services and technologies related to the efficient supply, distribution and use of energy;
- to ensure the effective dissemination within the UK of the results of RD&D work, so that timely commercial development of services, capabilities and technologies based on the work might take place;
- to manage its RD&D programmes economically and effectively, involving, where appropriate, collaborative arrangements at national level in order to maximise the benefit for the UK and to ensure that, as technologies approach commercialisation, responsibility for funding industrially-oriented RD&D is progressively transferred to industry.

2. The Department takes the view that ISPs should be judged on the grounds of their compatibility with our RD&D objectives. In some cases international collaboration offers benefits which leads the Department to believe that creating or joining ISPs could better serve the Department's objectives than a purely national programme.

3. The ISPs in which the Department is engaged fall into five categories:

- European Community (EC) programmes
- International Energy Agency (IEA) and Nuclear Energy Agency (NEA) programmes, under the auspices of the OECD
- International Atomic Energy Agency (IAEA) programmes
- Bilateral R&D collaboration under Memoranda of Understanding (MOUs)
- Large multilateral projects in the field of nuclear energy.

These are described in some detail in Annex I, International Energy R&D.

THE DEPARTMENT'S EXPERIENCE OF ISPs*Advantages and Disadvantages in Joining ISPs*

4. There are potentially substantial benefits in international collaboration. The pooling of scientific knowledge and expertise can act as a stimulus to solving difficult problems, in particular by the introduction of new ideas and different viewpoints. Participating institutions broaden and update their knowledge base through the interchange of knowledge and expertise with foreign counterparts.

5. It is also a substantial advantage to be able to share the costs of expensive programmes or facilities, which may often carry the risk of failure on technical grounds. In the case of the Joint European Torus (JET), for example, the cost of the programme was so great that no member state could have borne it alone. The benefit of only having to bear a proportion of the cost of the programme does, of course, have to be weighed against the additional costs associated with an international programme, e.g., the greater travel and organisational costs involved. In general, however, the net cost to the UK is lower than a purely national programme.

6. A subsidiary benefit is that where a new commercial technology field emerges from an ISP the participating institution is well-placed to exploit its involvement in the R&D phase. Industrial regulations which arise from ISPs tend to be harmonised throughout the participating countries leading to less confusion and easier compliance in subsequent commercial enterprises.

7. The UK benefits from the establishment of relationships between officials of national Governments through ISPs in which Departments are closely involved. These may help overcome problems in working relationships in other fields.

8. One disadvantage which must be borne in mind is the loss of direct control and management associated with involvement in an international programme. The Department's technical priorities may not accord exactly with those of its partners, so that the resultant (compromise) research programme may not

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meet our national objective as well as would a purely domestic effort. This may be the case with EC programmes in particular, where a single programme is designed to accommodate the objectives of all 12 member states.

9. It is also possible that even though an international research programme initially meets the Department's needs, with changing circumstances over time, the Department may reassess its energy policy or associated technical objectives. As a result the Department might wish to redirect, run-down or withdraw from a research area. However, the views of its overseas partners may remain enthusiastic, making such a change difficult or impossible.

10. The degree of overall benefit to the Department of joining an ISP may therefore depend in part on the framework under which it is established. We have found the IEA (see also paragraph 20 below) particularly satisfactory: its flexibility has allowed us to match our collaborative commitments well with our own RD&D priorities as they develop over time; it has also sensible guidelines on progress review, dissemination of results, etc., which encourage well-planned proposals for programmes.

Advantages and Disadvantages in Hosting Large Facilities

11. Hosting a large facility will in most cases create a UK centre of excellence in one or more key areas associated with the programme. This can result in visiting experts remaining here when their involvement in the programme which originally brought them to the UK is over, thereby enriching the UK's standing in those particular subjects. Conversely, if the facility is hosted abroad, it might produce a long-term "brain drain" from the UK.

12. It is possible that hosting large facilities may benefit the economy of the host nation through associated industrial contracts or technological spin-offs; the evidence for this is, however, far from clear.

13. A disadvantage of hosting is that the pressure on the Department to continue with an ISP which no longer meets our needs, of becoming in effect locked in, as mentioned above, is generally greater. There is also the risk that a programme involving a large UK-hosted facility will come to dominate any national programme running alongside it and in so doing deprive the national programme of some of its resources and freedom to pursue independent lines of research.

14. The Department's major experience of hosting a large facility has been the JET project. JET is the flagship of the Community fusion programme. It has proved a substantial success in scientific terms and greatly increased our understanding of the fusion process and the major problems that still await solution. Many of our European partners have been encouraged by it and other achievements in this field although more recently experts have predicted that fusion will not become viable for another 50 years, by which time the global energy situation, which fusion is designed to address, will itself have changed significantly as we have indeed seen already. However, treaty arrangements and our other international obligations in this area preclude a flexible response to changing events unless a majority can be found to change the programme. A further extension of the statutory life of the JET project, from 1992 to 1996, is in prospect.

15. A medium-sized but still substantial facility hosted by the UK was the pressurised fluidised bed combustion of coal test facility at Grimethorpe (a project which pre-dated the current British Coal proposal for the Topping Cycle). The programme stemmed from an agreement in 1975 under IEA auspices between the FRG, the USA and the UK and ran for 10 years. The UK share of the cost was borne by the Department and the National Coal Board (NCB).

16. The arrangements provided a useful opportunity to familiarise German and American scientists and industrialists with UK scientific and industrial capabilities. The numbers of staff involved were sufficiently small that special infrastructure (e.g., international schooling) did not have to be set up as at JET.

17. The programme provided valuable technical information to enable pressurised fluidised beds to be designed with reasonable confidence and demonstration plants are planned in other countries. In 1985 when the tripartite programme terminated, work was continued at a national level by the NCB in collaboration with the Central Electricity Generating Board (CEGB).

Machinery for Setting Up ISPs

18. The machinery for setting up ISPs in which the Department is involved is in most cases already determined by the rules of the umbrella organisation. For example, EC programmes are generally constrained by the relevant Articles of the Treaty of Rome and Euratom while the IEA has established rules for setting up Implementing Agreements. It is only during major revisions of these arrangements that these mechanisms might be changed.

19. In other cases ISPs tend to grow from informal discussions between individuals in different countries who have recognised common technical objectives and complementary resources. These may also lead to the signing of a bilateral MOU.

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20. The arrangements for international collaboration within the IEA are highly regarded in this Department. The chief advantages are that collaboration is voluntary, flexible (any two or more countries may choose to collaborate) and efficient in that all IEA programmes share a common legal and administrative framework. Without a structure such as the IEA the same level of collaboration could only be achieved through a profusion of individual bilateral and multilateral agreements which would require a large Departmental effort to negotiate and service.

Technical and Financial Criteria

21. The Department's technical criteria are that the ISP's technical objectives should be consistent with the Department's overall objectives and that the goals and methodology should be realistic.

22. The Department must be satisfied that a prospective ISP provides value for money. To this end, the financial criteria applied are those used for appraising our domestic R&D programme, with the additional costs of foreign travel, etc., and the risk of becoming locked in being weighed against the additional advantages of engaging in a particular ISP.

Forums in which decisions to participate are reached

23. In the case of EC programmes the UK is automatically committed to participation, unless the programme is established as a Community Joint Undertaking under Chapter V of the Euratom Treaty. However, the overall scope of a programme is influenced in the discussions at official level before its agreement by the Council of Ministers while Departmental officials influence the technical content in subsequent drafting stages. At project level Member States influence the selection of a series of projects in expert working parties in which UK delegates sit. National experts cannot ensure, although they can strongly influence, acceptance of a proposal.

24. Proposed new IEA Implementing Agreements and proposed new work under existing Implementing Agreements are, in the first instance, assessed technically by the appropriate Departmental officials. Where appropriate, the industrial contacts will be consulted informally. When the technical and financial soundness and the potential benefits of the programme have been established the final decision to participate is made by the R&D programme manager in the case of participation funded by the Department. There is also considerable participation by other organisations from the UK—Industry, Local Authorities, consultants, etc.—and in these cases the Department's role is usually limited to endorsement of the suitability of the organisations concerned. The same procedures are followed where proposed new NEA agreements are being set up or proposed new work is to be carried out under existing Agreements.

25. In the case of the IAEA the Department is not involved in any scientific programmes. Members or groups of members desiring to set up a project or programme of work—which of course would be for peaceful purposes only—would submit their case to the Board of Governors for consideration. The Board of Governors in turn prepare a programme and budget for final approval at the Annual General Conference. Programming is undertaken biannually, but the budget has to be approved annually.

26. When a new MOU is being negotiated the areas for inclusion are arrived at through comparison of the two countries' lists of priority areas.

Treasury/Cabinet Office Guidelines

27. The guidelines, which are relatively recent, were formulated in a Cabinet Office committee where the Department is represented by those officials responsible for co-ordinating international programmes. The appropriate people are therefore aware of the guidelines and employ them in their normal role of advising on proposals for new ISPs.

Impediments within the UK

28. Within the UK there are no major impediments beyond budgetary constraints.

29. The issue of relative UK salary scales has arisen in connection with the JET programme. JET has no permanent employees. UKAEA employees seconded to JET receive the same terms and conditions as their colleagues doing similar work in other Authority establishments. Nationals of other countries assigned to the project all become temporary employees of the Commission and attract higher Commission rates of pay. Some UK staff at JET have expressed dissatisfaction at this situation, and in 1985 it was challenged in the European Court of Justice. The ECJ in 1987 ruled that the UKAEA, as host organisation for the project, was in a different position from other member organisations and that this provided objective justification for the difference in treatment established by the JET statutes.

30. Issues of commercial secrecy and intellectual property rights have to be addressed when the Department is considering possible involvement in ISPs. However these do not present many problems in practice as the Department is not generally involved in ISPs which include near-market research.

*15 November 1990]**[Continued]**Impediments to other countries joining ISPs*

31. Impediments within other countries to joining ISPs will be similar to those which we observe in the UK. However on occasion there can be additional problems. For example some countries require an act of parliament to sign any international agreement, which can seriously delay proceedings.

Department of Energy

September 1990

ANNEX 1

International Energy R&D

This Annex sets out briefly the various ways in which the Department of Energy collaborates with other countries, either directly or through international organisations, in pursuing its Research and Development objectives.

2. The main channels of interaction are the European Community (EC), the International Energy Agency (IEA) and the Nuclear Energy Agency (NEA), both under the auspices of the Organisation for Economic Co-operation and Development (OECD), the International Atomic Energy Agency (IAEA) and direct bilateral or multilateral agreements whether formal or informal.

European Community**NON-NUCLEAR ENERGY**

3. R&D is carried out under the Framework Programme. The main vehicle is the JOULE programme covering Energy Conservation (often referred to as Rational Use of Energy—RUE), Renewable Energy (RE), Fossil Fuels including hydrocarbons and solid fuels, and a relatively small sector on Models for Energy and the Environment. The current programme started at the beginning of 1989 and has a budget of 122 MECUs (million European Currency Units) over 3.25 years. Some of this will go to meet administrative costs. A new programme beginning in 1990, was agreed in outline under the new (third) Framework Programme with a budget of 157 MECUs. Details of the programme, which will overlap the JOULE programme, are still under discussion and may be finally agreed around the end of 1990. The programmes are administered by the staff of Directorate General XII (DG XII) of the Commission with the advice of a committee of experts from the member states. Calls for proposals are issued periodically and widely publicised in the UK by the Department. Proposals should be collaborative and, ideally, involve a spread of organisations from several member states and some involvement, preferably financial, by industry. Support can be up to 50 per cent (or 100 per cent of marginal costs in the case of universities and similar bodies) but the recent tendency has been for less to be offered to spread funds further.

4. Apart from the R&D programmes under DG XII there is also the THERMIE programme under the Energy Directorate, DG XVII. This provides support for Demonstrations (i.e., first commercial scale applications) of novel and beneficial energy technologies, for 'Targeted' projects to be set up by the Commission to meet specific perceived needs and for 'Dissemination' projects which give lower levels of support for projects involving technologies which are not fully novel but which need a further boost. In addition THERMIE provides support for technology projects in the Hydrocarbons Sector. These are late-stage development projects extending in some cases to prototypes rather than demonstrations. The budget of 350 MECUs over 1990-1993 inclusive together with an indicative figure of a further 350 MECUs over 1994-1995 have been agreed. DG XVII is also assisted by an advisory committee, the 'ACMDP', which sets priorities before calls for proposals and selects projects. International projects are encouraged but, by the nature of the projects, few and far between.

5. DG XVII also administers the Research Aid programme under Article 55 of the European Coal and Steel Community (ECSC) Treaty. Around 27 MECU is available annually for coal research—mainly in mining—based upon a levy on the value of member industry production, and the programme offers up to 60 per cent aid for industry projects and 100 per cent for those from universities.

NUCLEAR FISSION—SAFETY

6. The Community's nuclear safety R&D activities, which are carried out under the Framework Programme, derive from the Euratom Treaty. The Treaty recognised the development of a strong European nuclear industry. This was to be achieved with proper respect to the health and safety of the nuclear workforce and the general public. Its principal objective is safety in the design, construction and the operation of all nuclear reactors to be achieved by acting to prevent accidents and to reduce the consequences if the preventative measures are not able to avoid the accident occurring.

7. Through shared cost programmes, special attention has been paid to evaluating source terms in various levels of accidents—such as coolant losses, human errors, and global risks. Methods of probabilistic safety analysis and evaluation have been developed and improved.

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8. Future activity will be concentrated on generic issues such as severe accident management, the man-machine interface, inherently safe reactors and operational safety.

9. **TELEMAN**—Early in 1989 a new five-year shared cost action research and training programme on remote handling in hazardous or disordered nuclear environments was adopted. Although tele-operators already contribute to the safety of the nuclear industry from mining through to reactor operation, reprocessing and decommissioning, this particular programme will concentrate on the contribution they can make to nuclear safety in the areas of accident management.

NUCLEAR FISSION—RADIOACTIVE WASTE MANAGEMENT, DECOMMISSIONING AND NUCLEAR FUEL CYCLE

10. The Community's R&D activities in this area, which are carried out under the Framework Programme, cover all the activities necessary for the supply of fuel for nuclear power plant. These include the extraction and enrichment of uranium ore, manufacturing and re-manufacturing following reprocessing of nuclear fuel elements plus the management and storage of radioactive wastes and decommissioning of nuclear plant.

Radio waste management

11. The management of radioactive waste is developed and supported by most of those countries of the Community having nuclear programmes. Research has been and is being carried out at Community level by shared cost action programmes as well as a direct research programme executed by the Joint Research Centre at Ispra (JRC).

12. The shared cost action programmes on waste management R&D include development actions on system studies, treatment and conditioning of radioactive waste, qualification of engineered barriers, the development of repositories, the safety of geological disposal and the elaboration of management policies. A new five-year (1990-94) programme has modified these programmes by increasing the activities on natural analogues and enlarging the supporting activities to the projects on construction and/or exploitation of underground facilities.

13. The waste management R&D programmes at the JRC cover the studies on the treatment and solidification of reprocessing waste, waste characterisation and the safety of geological disposal.

Decommissioning of nuclear plant

14. In all countries having nuclear power programmes there exist nuclear installations which are being or have been shut down and of which only a small number have been dismantled. As more and more nuclear installations reach the end of their useful lives, the number requiring decommissioning will greatly increase.

15. Research in Europe in the early 1980's was rather dispersed. However, a more systematic and coherent action to be undertaken at Community level was planned and a five year (1984-88) programme was put in place with the aim of establishing joint development of the management of decommissioning. The practical testing of techniques which are used in decommissioning operations are therefore performed on a large scale by Member States through shared cost action programmes.

16. The 1984-88 shared cost action programme covered research and development on the long term integrity of structures, decontamination, dismantling techniques, treatment of specific wastes, containers of large dimensions and system studies. In addition, action on qualification and adaption of semi-autonomous telecommanded handling systems has been added to these lines of decommissioning R&D for the current, 1989-93, shared cost action programme. The 1989-93 programme also includes support for the decommissioning of the Windscale Advanced Gas-Cooled Reactor (WAGR), costs of which are being met by the Department.

Nuclear Fuel Cycle

17. Up until the early 1970's the USA had not only mastered, but had also the world monopoly for the production of civil enriched uranium. However, since then all phases of the fuel cycle have been developed in the Community on an industrial scale and in a commercial sense. Through the large uranium enrichment facilities in France (Gaseous Diffusion technique) and Urenco with plants in West Germany, the Netherlands and the UK (the centrifuge process), these countries supply Europe and export on the world market enriched uranium in competition with the USA and USSR. The reprocessing of spent fuel is also carried out on an industrial scale both in France and the UK; the largest such plants in the world are at Cap La Hague and Sellafield.

18. The importance of investment, in order to obtain a profitable capacity, excludes practical initiatives from smaller countries. Nevertheless, other Member States of the Community, in particular Belgium, are closely associated with other countries on various fuel cycle phases, such as fuel fabrication.

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19. All the activities that are related to the fuel cycle have to be carried out in such a way as to guarantee the peaceful use of the nuclear materials so that the work on safeguards and fissile materials management meet a Community obligation to implement nuclear safeguards in the framework of the Euratom Treaty, the Non-proliferation Treaty and supply agreements with third countries.

20. The JRC through its R&D programme acquires the basic scientific knowledge and ensures that it gets acquainted with new technologies needed to provide effective support to safeguards inspectors of the Community and IAEA. The R&D programme is oriented towards:

- (a) the study of the safeguards and fissile materials management techniques and the demonstration of the way that they can be integrated in the inspection and plant operation activity, and
- (b) the performance assessment of instruments and devices under realistic field conditions.

NUCLEAR FUSION

21. The UK plays host to the European Community JET (Joint European Torus) project at Culham and the UK's domestic fusion R&D programme is fully integrated, under a Contract of Association with Euratom, into the Community Fusion Programme (CFP) aimed at investigating the scientific feasibility of nuclear fusion as a source of electricity generation in the longer term. During 1990 the Community has just undertaken an independent review of its fusion programme, including JET, which will have an important effect on strategic decisions due to be taken shortly in Europe on a new CFP and on a possible further extension to JET to 1996.

22. JET is the largest project in the CFP with its own statutes and Council. JET's mandate is to construct, operate and exploit a large torus facility to obtain and study plasma in conditions and with dimensions approaching those needed in a thermonuclear reactor.

23. On JET funding, the UK pays a 10 per cent host country premium which currently amounts to around £8M per year. The remaining expenditure is met 80 per cent by Euratom (to which the UK currently contributes around 20 per cent in own resources) and 10 per cent by national Associations in proportion to the amount they receive from Euratom for their domestic fusion programmes. The United Kingdom Atomic Energy Authority (UKAEA) is the UK participant and contributes about a further 1 per cent through this route. The indirect UK contribution through Euratom is £12M and thus the total annual contribution by the UK is currently about £21M.

24. The total value of contracts awarded by JET to the end of 1988 was 622 mecu (approximately £410M). Of this 50 per cent has gone to the UK, 20 per cent to the FRG, and the balance to other participants in the project. The majority of posts on the project have been filled from the UK—in 1988, 260 from UKAEA (on secondment), 191 temporary Euratom staff, 19 from DG XII and 210 contract posts. There are no permanent posts in JET.

25. The JET statutes impose a legal obligation on the UKAEA, as host organisation, to take over responsibility for the decommissioning of JET at the end of its life. Since the establishment of the undertaking the estimate of these costs has increased in a way which could not have been foreseen when the Project was begun in the 1970s. This has arisen largely from tightening of the regulatory regime and heightened public sensitivity to radioactive waste management in general.

International Energy Agency (IEA) and Nuclear Energy Agency (NEA)

26. The IEA is a non-funding body under which R&D collaboration takes place on an "à la carte" basis. It involves all major OECD countries other than France although France is now participating in some areas on an informal basis. In its R&D mode the IEA provides a forum for the broad discussion of R&D needs and policies at a senior level (the Committee on Research and Development or CRD) and, below that level, four permanent Working Parties covering Energy Efficiency (End-Use Technologies), Renewables, Fossil Fuels, and Nuclear Fusion. Nuclear Fission is taken by the International Atomic Energy Agency in Vienna and not considered in the IEA. Under these Working Parties so-called Implementing Agreements, often with numerous Annexes, are set up in which organisations from two or more different countries, often but not necessarily governmental, co-operate on specific subjects of interest. There are two common modes of participation—task-sharing and joint funding. In the former information exchanges take place or co-ordinated work on a specific subject is carried out with each paying its own costs. In the latter each puts money into a common pool to support a large project to be carried out in a single location. Joint funding is now rare except in the case of information centres.

27. The UK regards the IEA as a very effective mechanism for collaboration in that the only expenditure required is a small sum for the support of a small secretariat in Paris and the travel and subsistence of officials attending CRD and Working Party meetings a few times a year while opportunities are provided or can be created for collaboration on virtually any subject of interest to the Department with almost any countries with which we are likely to wish to collaborate.

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28. The NEA is another specialised agency within the framework of the OECD—an intergovernmental organisation based in Paris. The membership of the Agency numbers 23 industrialised market economy countries.

29. The main objective of the NEA is to further the development of nuclear power as a safe, environmentally acceptable and economic energy source. The Agency itself does not undertake R&D activities but it sponsors several co-operative R&D projects. The OECD-LOFT (Loss-of-Fluid Test) Project, located in the USA, has been concerned with the response of the reactor system under accident conditions. The Halden Reactor Project, sited in Norway, considers the behaviour of reactor fuel under abnormal conditions and the interaction of the operator with the nuclear plant. The Programme for the Inspection of Steel Components (PISC) is designed to develop and test inspection techniques for locating and measuring flaws in the reactor's primary circuit and structural steel components. The NEA also helps sponsor the International Stripa Project in Sweden, an experimental research programme to investigate the suitability of granite as a medium for isolating radioactive wastes.

Bilateral and Multilateral Agreements

30. As implied above the policy of the Department has, in non-nuclear energy, tended to be to rely on the IEA for international collaboration outside the European Community programmes rather than bilateral agreements. However some 50 per cent of the western world's energy R&D is carried out in the USA and we therefore see benefits in a bilateral agreement with the USA. A MOU covering several areas of non-nuclear energy was signed six years ago and has proved useful, especially in the coal and solar energy areas. This MOU finished in October, 1989, and was extended, first by exchange of letters and then, in June, 1990, formally for a further 10 years. It covers all areas of non-nuclear energy together with their environmental implications.

31. A outline bilateral agreement was also reached with Israel (a non-IEA country) in 1988. This takes place under an existing umbrella agreement in which DTI normally takes the lead. Exchange areas include wind and solar energy, the energy use of wastes and possibly oil shales. There are also bilateral agreements with Russia and Greece.

IAEA Research & Development

32. The main activities of the IAEA are not R&D orientated. The Agency is principally concerned with maintaining the international safeguards system, providing technical assistance to less developed countries, and acting as a forum for discussions and exchange of views on nuclear safety and technology. The only R&D which the Agency does itself is in support of its technical assistance activities.

33. Instead, the Agency seeks to promote nuclear related R&D by acting as a focus for discussion through the wide variety of technical committee meetings, advisory groups, etc., it hosts. The Agency also encourages information exchange and the co-ordination of activities by initiating and organising Co-ordinated Research Projects between Member States.

34. On nuclear energy, much of the Agency's work is directed towards the established technology of nuclear fission, but the Agency is playing an increasingly significant role in the field of nuclear fusion R&D, most lately in the International Thermonuclear Experimental Reactor (ITER) project which was launched under the auspices of the Agency.

35. As well as placing research and technical contracts, the Agency's two laboratories at Siebersdorf in Austria and the International Laboratory of Marine Radioactivity in Monaco, carry out a wide range of programmes on the application of nuclear techniques into, e.g., radiation dosimetry, animal production and health, safeguards techniques, and radiation in the marine environment. The Agency also has an interest in the International Centre for Theoretical Physics at Trieste, which carries out research in the fields of advanced Physics and Mathematics.

Fast Reactor Collaboration

36. In his statement of 21 July 1988, the then Secretary of State said the Government would provide funding for the operation of the Prototype Fast Reactor (PFR) at Dounreay until March 1994 and for the associated reprocessing plant (to deal with the spent fuel) until March 1997. He also made clear that, as from 1990-91, there would be a "core" R&D programme of £10 million in 1988 money. Mr Parkinson said this programme would retain a position in the technology for the UK at economic cost; and that it would provide a basis for continued co-operation with our partners in the European Fast Reactor (EFR) collaboration (UK, France, Federal Republic of Germany).

37. Three agreements have been signed under the collaboration:

- (a) The Conceptual Design Agreement between the fast reactor design companies (National Nuclear Corporation (NNC) for the UK) to collaborate on the design of the EFR until March 1990;
- (b) The R&D Agreement between the national fast reactor R&D organisations of the partner countries (UK AEA for the UK) to collaborate on an R&D programme in support of the EFR design;

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- (c) The SERENA/FASTEC agreement which provides the basis for the sharing, protection and licensing of the know-how developed by the design and construction companies and the R&D organisations involved in the other two agreements (FASTEC is 51 per cent owned by NNC Ltd, 49 per cent by the UK AEA).

38. The EFR partners completed the conceptual design phase of the EFR this year and hope to accomplish the more detailed concept validation phase by March 1993.

Energy Technology Division,
Department of Energy

September 1990

Examination of Witnesses

DR W D EVANS, Head of Energy Technology Division, and DR E H T WALKER, Head of Atomic Energy Division, Department of Energy, called in and examined.

Chairman

484. Dr Evans, may I thank you and your colleague very much for coming and giving evidence to us this afternoon, and thank you too for your very clear and helpful paper. You can see who we all are. You may not know our specialist advisers, Dr Mick Lomer and Professor Roger Williams. Would you like to introduce yourselves, and if there is anything you would like to say in amplification of your paper, please do so.

(*Dr Evans*) Yes. I am David Evans and I am the Department's Chief Scientist, and my colleague is Dr Timothy Walker, who is the Head of our Atomic Energy Division and is responsible there for the nuclear R&D policy within the Department, so I hope he will be able to assist the Committee on the nuclear questions and I will do my best to assist the Committee on general questions and on questions to do with the non-nuclear side of our activities. Other than that, I do not think I have anything that I want to say to add to the memorandum we have already given you.

485. In your memorandum one of the things you said was that you found co-operation under the International Energy Agency particularly satisfactory. Does that mean that you found other methods of co-operation less satisfactory? Would you like to make comparisons at all between co-operating under the IEA and co-operating under the European Framework Programme or under any other programme?

(*Dr Evans*) I think that conclusion, although perhaps it might be drawn from the wording, was not intended in what we said. I think it is important to distinguish between the different kinds of organisational structure which we operate in when we collaborate under the different agencies, but particularly contrasting the International Energy Agency and the European Community. The most important distinction which I think you have to bear in mind is the question of where the money comes from. Within the European Community Framework Programme, it is the Community which can provide from its own resources the money which comes to the Community from VAT and other trade levies and such-like which can be used to finance R&D. In the case of the International Energy Agency,

participating countries bring their own finance to the programmes which they want to finance. The role, therefore, of a ministry or a department like my own in relation to those programmes is actually quite different. We aim, in relation to the European Community programmes, to persuade on technical grounds through participation in technical advisory committees and on political grounds through our discussions on R&D programmes at the Council to arrive at Community R&D programmes which we think are right in whatever area. In the case of the International Energy Agency, we go along, so to speak, with our chequebooks and we actually say, "We are interested in financing a project doing such-and-such a thing. Are there other countries which have a similar objective where we can club together and get a better technical outcome and better value for money for our expenditure through doing it together with you rather than doing it separately on our own?" Our comment in relation to the International Energy Agency is that we have found in our experience over the last ten years that it provides an extremely good framework for multilateral collaboration in energy technology and that, I think, arises from two things: that there is a very wide experience over the last ten or 15 years that we can draw on on the legal form and the legal basis for such collaborations within the International Energy Agency, but also the general meetings which take place within the International Energy Agency on technical areas give good visibility and a good opportunity for the scientists and technologists operating in certain areas to find out what their partners are doing and, more important still, what their partners are planning to do in future. That allows for collaborations to come forward in much the same way as Lord Flowers was talking about in the case of universities in areas which we believe to be of mutual benefit. The collaborations come forward on, so to speak, an *a la carte* basis; you choose the things you are interested in and you only participate for the duration that you want to. You choose, and it is in that sense that I think our memorandum said that we had found the International Energy Agency to be a particularly valuable way of collaborating internationally.

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[Continued

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486. Your Department has been active in actually proposing projects for collaboration under the AEA?

(*Dr Evans*) Indeed that is true. Only this summer we have with British Coal put forward a major new idea to investigate the implications for the greenhouse effect of coal producing technology and it looks very much as though we will get what is called an Implementing Agreement—a general framework agreement for collaboration—supplemented by Annexes covering specific technical areas. In that area British Coal will be carrying forward with the Department of Energy—with some British Coal money and some Department of Energy money—something of that kind, with a number of other countries. I could not give you the precise numbers but it looks very much as if we will have that and that is a British Coal initiative supported by the Department.

Lord Sherfield

487. Where is the International Energy Agency?

(*Dr Evans*) The International Energy Agency is part of the OECD in Paris.

Chairman

488. In this case only your own Department is involved in most of it?

(*Dr Evans*) No, in the vast majority of the UK's participation under International Energy Agency agreements we have nominated another partner, sometimes a research agency and sometimes a commercial entity like British Gas or British Coal or sometimes a consultant—for example in building design and architecture.

489. But no other government department would be involved?

(*Dr Evans*) I am not aware of any SERC collaboration under this. I do not think there have been topics of interest to them.

490. This does not get into the machinery of the science and technology secretariat of the Cabinet office at all?

(*Dr Evans*) No, it does not.

491. For instance, if the Department of Environment were involved, would some other machinery be involved?

(*Dr Evans*) I believe that there are no examples—I would have to check precisely—but I am not aware of any examples of that. But if we felt that a topic was desirable for the UK to participate in but which was not the responsibility of our Department, I see no reason why we should not take the proposition to the other government department and say, "Look, we think this is a good thing. Would you like to get involved?"

Lord Flowers

492. Are there no projects backed by your Department and backed by the government on things like clean technologies which inevitably involve environmental considerations as well as the technological ones?

(*Dr Evans*) Those technologies under the collaboration in the International Energy Agency concerning clean technologies have been, I believe, technologies in which my Department has been interested in—things like clean coal—where we have had the lead in these areas.

493. You then look after the environmental aspects of these things, is that right?

(*Dr Evans*) Indeed, that is correct.

Lord Kirkwood

494. Would it not be true to say that with the sort of machinery you have mentioned you find the collaborating nations tend to be the rich and progressive ones and there is some political advantage in encouraging the rather less advanced nations to join such schemes. They are likely to be excluded by that sort of machinery, are they not?

(*Dr Evans*) The International Energy Agency has as its membership the OECD countries, minus France although we understand France is trying to become a member. It made a decision this year to try and become a member. So predominantly it is actually the rich countries who sit around the table and discuss the topics. The main focus of activity in this, I think, has been to discover the areas of common interest within that group of countries and not to carry out technology transfer outside the area of OECD. There has been some interest in the last year or so in looking at the possibility of technology transfer to East European countries through the International Energy Agency but I do not think that has yet reached the stage where there is any well-founded mechanism. It is something under discussion rather than something on which there is yet any formal policy or agreed mechanism to deliver.

Chairman

495. It probably would be through the IEA that it would be done?

(*Dr Evans*) That is what is under discussion, whether there are possibilities to do that, yes.

496. To turn to the European framework Programme, do you find any discrepancies between the priorities of the programmes as it goes out and those that you would really like to see following from your own priorities?

(*Dr Evans*) The European framework programme inevitably has to reflect the priorities or hopefully reflects the priorities of the member states as a whole. Before it is decided it goes through an

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and DR E H WALKER

[Continued]

[Chairman *Contd*]

elaborate Community discussion procedure which I think I referred to at the outset. It is inevitably the case that there is some compromise between the views of different countries in such a process. For example, if I could refer to the renewable energy activity which is a relatively small part of the framework programme. It is about a third of the non-nuclear energy programme and that programme is itself a small programme. Some of the things that are examined under that are of interest only to some countries. For example, under a bio-fuels programme in one year there was a concentration on crops which were only of interest to southern European countries and we have to accept, therefore, that there is, so to speak, a portfolio of interest covered by the technologies being examined and we will not be interested in all of that portfolio. But as a whole we would reckon that, taken in aggregate, the priorities of the framework programme to a reasonable extent reflect the UK's priorities.

497. It does not cause you great trouble?

(*Dr Evans*) We find that the Commission is in general very receptive to the views of the technical advisory committees in which we participate and we find that they do listen clearly to the views that are being expressed. They have, of course, to listen to the views which come from 12 different member states which may have different infrastructures, different climates and therefore have different priorities for some different technologies.

498. In the energy field how is the principle of "subsidiarity" applied?

(*Dr Evans*) We would along with the Commission, I think, agree that the principle of "subsidiarity" ought to apply in the sense that it is not appropriate to do things at a Community level which are better done at national level and there are, as in the example I referred to already on renewables, arguments which might push in the direction of saying the Community should not do anything in the field of bio-fuels because it is all too disaggregated and the needs of Community countries are too disaggregated. However, I think that would neglect the possibility of some international benefit in this technology.

For example, some of the technologies which are of benefit in Northern Europe, such as wind power, can be provided by bringing expertise from Northern European countries such as Denmark, where wind power is very well advanced, to the United Kingdom or to France or to Germany. So as I say, the application of subsidiarity in some of the areas is not as simple or clear as it might be in other areas.

499. Although it might be cheaper and easier to do it on a bilateral or small basis?

(*Dr Evans*) That is a possibility and in those circumstances we can, of course, return to the International Energy Agency and find a readymade vehicle there for our collaborations.

Lord Flowers

500. But detail apart, do you now feel as if the Commission is the driving force behind the European collaborations in science and technology or not? We have to get the agreement of Member States and so on and so forth, I understand, but who is in the driving seat?

(*Dr Evans*) In relation to the Framework Programme I would say that the Commission obviously has a key role. It has to aggregate the views of Member States and it has to make the reconciliation where there are divergencies, as there are divergencies. In that sense I would say under the Framework Programme it does play a key role but I would not want to underplay both their responsiveness to the technological arguments we put to them about our own experience and the results of our own national programmes.

501. Do you feel you have been fairly successful in influencing the energy part of the European Framework Programme?

(*Dr Evans*) My colleague may want to say something more on it but let me say in relation to the non-nuclear side that in broad general terms we are satisfied that they do pay adequate attention to the kind of input we make.

(*Dr Walker*) If I could add to that and draw out from what my colleague has said. It is true that in the Framework Programme the position is that it is up to the Commission to make proposals under the Treaty but clearly, particularly in the nuclear area, there is a lot of collaboration outside the Framework Programme within Europe and the initiative is normally taken by relatively small numbers of Member States working together. Therefore, I just want to stress the point that, although the Commission takes the initiatives within the Framework Programme, there is always scope outside the Framework Programme, even within the Community as well as in other agencies such as the IEA or, indeed, on a purely bi- and trilateral basis, for individual Member States to take initiatives.

Lord Nelson of Stafford

502. Do you see an upsurge of new proposals coming forward under the current green programmes which are being pursued and which are particularly relevant to the energy field?

(*Dr Evans*) Under the most recent Framework Programme there was a modest—and I have to say modest—increase in the size of the programme for non-nuclear energy R&D and part of that programme has been allocated to energy technologies which have environmental benefits, particularly the coal parts of the programme.

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[Continued]

[Lord Nelson of Stafford *Contd*]

503. Including utilisation as well as generation?

(*Dr Evans*) Yes, exactly so, but I have to say that is a relatively small programme. Under the most recent Framework Programme, the most recent edition, it is only 150 Mecu out of 6 or 7 billion ecu, so it is a relatively small programme. But that is one part. The other parts are energy efficiency and renewable energy, both of which can be helpful in meeting environmental concerns, and the hydrocarbons sector, that is, the exploitation of oil and gas, but that does not have a particular environmental focus.

504. Why was the fluidised bed programme closed down?

(*Dr Evans*) The major collaboration of which I am aware in which we have been involved in fluidised beds was the Grimethorpe programme, which was an IEA programme, where there was a collaboration between three or four Member States of the IEA. That ran, I think, from about 1977 to 1984 and it involved the building of a major test facility, a £60 million test facility, for pressurised fluidised bed combustion. It was an experimental facility and when it completed its original work under the International Energy Agency agreement the partners felt that sufficient work had been done for their purposes and then took the results which had been gained off to their national programmes. For example, in the USA the results of that activity have led to the building on a demonstration scale of a 70 megawatt power station using that technology. So the technology is not dead; the experiment completed its work under the IEA agreement.

505. It is being promoted commercially now?

(*Dr Evans*) Indeed.

Lord Kirkwood

506. In the United Kingdom?

(*Dr Evans*) Let me take the story forward, so to speak. Following the termination of that IEA agreement, in 1984 there was an international agreement with the United States and I think maybe one other country to look at the performance of for example different kinds of coal water mixtures in the same facility. So the facility continued and there was another, I think, £30 million of research continued and carried on. That work came to a conclusion towards the end of 1988. British Coal, who own the facility, then considered carefully what might be done with it and proposed a continuation of a research programme using that facility into an advanced electricity generating technology which they call the topping cycle, which is a combination of combustion of coal in the pressurised fluidised bed burner with the addition of combustible gas to the hot flue gases. Those gases are cleaned and then put into a turbine and the gas is burnt to increase the temperature and increase the efficiency of combustion because you have a higher temperature. That project was supported by the Government to the

tune of 50 per cent. in the summer of 1989 and the work has continued ever since on that programme. Unfortunately, the commercial partner in that programme dropped out in April of this year and British Coal are still at this very moment trying to negotiate to find some other commercial partners in order to participate in that.

507. By "commercial" do you mean plant manufacturers or generators?

(*Dr Evans*) Plant manufacturers. The generator PowerGen is involved in the programme already and that work has not stopped. The work is carrying on and in fact it looks as though it will be completed satisfactorily. So the life of that facility—a very expensive, very large facility partly paid for out of an international collaboration—has been extended through to this very day and has enabled British Coal, with support from the Department, to investigate another and very interesting electricity generating technology which looks as though it has considerable promise for high efficiency and low pollution electricity generation for the 1990s. So I think that would be an example of a very significant benefit coming to the United Kingdom out of an international collaboration.

Chairman

508. And with the experience of that and the experience of JET would you say that there are definite benefits to be gained from hosting a major project?

(*Dr Evans*) I would certainly cite that particular example as a clear benefit. Perhaps I might ask my colleague to say what he thinks about JET, as it is his area rather than mine.

(*Dr Walker*) On JET it is very difficult to produce any quantifiable statement of the advantages and disadvantages other than the purely scientific ones. Undoubtedly a large number of contracts have come to the UK that might not if JET had been placed in France or in Germany. At the same time we have paid a 10 per cent host country premium and we undertook to pay the decommissioning costs, which have grown to a very large extent since we undertook to pay for them and therefore the costs of hosting it have been quite large as well. On the one hand there are the advantages of employing a large number of technically qualified people and employing extra people who might not otherwise be employed. On the other hand there is the opportunity cost: increased people in the area may force house prices up and drive out small business that might otherwise have worked there. It is very difficult to form any real economic assessment. The decision was, of course, originally taken largely for political reasons. Ministers wished to have a large scientific project of this kind and there have been scientific benefits but the economics of an investment project on that basis are very difficult to establish either way.

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DR W D EVANS
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[Continued

Lord Flowers

509. When these assessments are done they are usually done more to a set of agreed rules or procedures which I suppose ultimately are promulgated by the Treasury. Do you find the rules you have to use to bid for a project in this country are sufficiently flexible that you can take into account some of the not so easily quantifiable things, the cultural things and so on or are they so restrictive that you really cannot do that?

(*Dr Walker*) It is always possible to take them into account. If you want to adopt a strict cost benefit approach you have to put a value on them and that obviously allows plenty of scope for judgement and argument but clearly when we address this kind of issue—the decision to host JET was taken almost 20 years ago now—one tries to make the best assessment at the time of both the completely economic and the other benefits and indeed costs and then ministers have to decide which in their view outweighs the other. The only thing I would say is that with hindsight many of the numbers change and, indeed, many of the perceived costs and benefits change and so it is always very difficult to compare, as it were, the view one might take now with the view that was taken at the time.

510. Would the view now be more favourable than it was 20 years ago?

(*Dr Walker*) I think the benefits of JET would possibly be viewed as less than they were at the time for one very important reason: the cost of de-commissioning. Obviously the UK undertook to pay what was then estimated by the Authority in current prices about £30 million and they now estimate it at about £100 million. Clearly that is a considerable extra cost which must affect ones assessment of a net benefit.

Chairman

511. The fast reactor project having been set up in a totally different way, would you like to see the European fast reactor change into something like JET or remain as it is from the financial point of view?

(*Dr Walker*) I think the advantage of the present collaboration on the fast reactor is that it does have a number of clear decision points. One is coming up in 1993 where the utilities who will be the eventual customer of a fast reactor, will be able to look at the design that has been produced and decide whether, in fact, they want to build a prototype. They may decide yes. They may decide no. That is a decision they still have to take but at that stage, when they have decided and if they have decided they want to build, they must then decide where because after that the design has to become specific to the actual site thus there are a number of clear decision points. There is one in 1993 and if the decision is to proceed there will be a clear decision point again in about 1998 or so, when they have a complete design specific to the site, on whether to go ahead.

Therefore, there are clear decision points or milestones, if you like, which allow all those involved to decide whether they want to go on. It is obviously more difficult to do that in projects which necessarily have a longer lifetime. It is also more difficult when more partners are concerned because there is bound to be a bigger range of interests.

Lord Sherfield

512. You listened to the previous evidence and you heard the questions I put about the effect of the prospective closing down of Dounreay and our participation in the fast reactor programme. It is obvious it is going to diminish the importance of our participation in the programme. Would you also agree that it might endanger or cripple the entire programme?

(*Dr Walker*) I would be surprised if that is the case. If a design is virtually complete by 1993 then clearly the impact of any work that is done after 1993 on that design is going to be rather less. It is also the case there is also a question as to whether the benefits of any further work at Dounreay is actually worth all the costs that will be incurred. It would cost about £50 million a year to run Dounreay and, as I say, if those results are unlikely to lead into a design then clearly their benefit is rather less.

513. But since the decision still seems to be to close the fast reactor you must have made these calculations already?

(*Dr Walker*) As I said, the intention is to reach an agreed design by 1993, a year before or a few months anyway before Dounreay closes.

Lord Flowers

514. My Lord Chairman, Dr Walker said something that took me by surprise, that by the time the design was finished there would not be much design work left. I do not know if that sounds right but it cannot be because whenever you are doing something new there is a substantial amount of design work that has to be done in the course of building a prototype and the people who do that ought to be the ones who take part in the original design. I would have thought that it was bound to weaken the project and their own position, of course, if we withdraw from the project.

(*Dr Walker*) I did not mean to give the impression there could be no benefit but given that the design would be largely finalised in 1993, the scope of the results from Dounreay affecting the design are very much less than they are now when the design is going on.

515. I am afraid I disagree with you. The design is not finished when you have drawn a line under that stage. There is always further design work when you are building a prototype.

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[Continued]

[Lord Flowers *Contd*]

(*Dr Walker*) There is always further design—although the experience of the nuclear industry in continually changing the design has not always been successful—but the degree of change to the design after 1993 when a design has been agreed on one, is bound to be less than before.

Lord Flowers] In all the projects I have ever come across that has not been the case.

Lord Sherfield

516. Is that really so, because after all, one of the advantages and importance of the fast reactors is as a test bed or test centre for the life and design of the fuel elements, and surely the importance of that will continue?

(*Dr Walker*) As I said, there comes a time when you have to decide what you are going to build. Clearly there is scope for changing the design even after you have taken that decision, and that happens, although it incurs considerable costs. My point was that once you have taken the basic decision on design the scope for research for the future design is less than it is before that decision. How much less and how much more is obviously a matter of judgment and experience and is different for different projects. However, I think as a matter of principle it is fair to say that finalisation of design, even in quotes, means less scope for change afterwards than before.

Chairman

517. Were our partners in the European project consulted before our Government made its decision about the future of Dounreay?

(*Dr Walker*) Yes.

518. Did they agree?

(*Dr Walker*) Their news affected the decision. I think it is fair to say that our partners and, indeed, all utilities, including the utilities in the United Kingdom, who were interested viewed the R&D work as more important than running Dounreay itself.

519. What about co-operation with the Americans? I think you said in the paper that the MOU with the Americans is useful in the fields of coal and solar energy. Are there difficulties in collaboration with the United States or not?

(*Dr Evans*) In fact the current Memorandum, which was renewed or signed again this summer, covers energy efficiency, renewable energy, fossil energy and waste related management and the environment. New areas can be added by mutual agreement of both parties. So we believe the scope of it is broad enough at the moment. There is no specific mention of nuclear collaboration in this Memorandum but, as I understand it, there are memoranda between the Atomic Energy Authority

and various parties in the United States, which means that there is no need for this Memorandum to cover nuclear energy.

520. Is there actually much collaboration going on under the MOU or not?

(*Dr Evans*) On the non-nuclear side there is not an enormous amount at the moment. There has been work on coal and renewable energy but in my Department we are working up at this very moment a new strategy for our coal R&D activities. The United States' coal activities are quite enormous, multi-billion dollar programmes. We believe that it is very important for us to maximise the benefit to the United Kingdom from such collaboration under that Memorandum. So I am very hopeful that we can pick up some collaborative projects with the Americans. The clean coal programme under the Memorandum is an expansion area which I have in view at the moment.

521. But either in the nuclear or the non-nuclear energy fields is there any tug-of-war between co-operating on a European basis and co-operating with other people such as the United States or Japan or anybody else?

(*Dr Evans*) In relation to the non-nuclear side, I would not see a conflict like that. I think there are benefits which we can take from collaboration with both European countries and with the North American countries, Canada and the United States. I come back to the fact that the International Energy Agency is OECD, so we do sit round the table, the members of the European Community, apart from France but we will probably have France before very long, and the Nordic countries, who are very active in energy technology—Sweden has some notable energy R&D programmes—Canada and the United States and Japan and so on. Therefore, we have the opportunity to collaborate with all those countries.

Lord Dainton

522. I wonder if I might ask a question which does not appear under the heading of the Department of Energy but which relates to the problem of attribution and what the Treasury is doing there. The Research Councils are very concerned about this and I would like to get some idea of the magnitude of the effect on the Department of Energy, in the first place; secondly, whether any sums which are involved are a matter of negotiation and is that negotiation a satisfactory form of negotiation between the Treasury and the Department of Energy; thirdly, whether, therefore, in the light of all that, you feel it is a constraint upon your own programmes which you would like to pursue?

(*Dr Evans*) You appreciate that I speak for the Department Energy as part of a joint government?

523. Absolutely.

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DR W D EVANS
and DR E H WALKER

[Continued

[Lord Dainton Contd]

(*Dr Evans*) The position of the Department is, however, slightly different from that of many other government departments in its approach to the financing of Community programmes, in that the history of the European activities on research and development is such that energy started first and started before any of these arrangements got in place, so that there has not been any very significant increase in Community expenditure on energy while these rules have been in place. There has not, therefore, been any enormous difficulty of, so to speak, having to offset bids for new energy expenditure in the European Community.

524. There is no retrospective element in the principles applied by the Treasury?

(*Dr Evans*) There is no retrospective element but I have something to add, and that is that in the context of normal expenditure discussions every year there is, as you will understand, a vigorous exchange between the Department and the Treasury about what is right to be spent and what should not be right, and on occasions the Community expenditure gets caught up in that. As you will understand, different departments express different views during the course of those discussions but at the end they all reach unanimity.

525. Unanimity is sometimes comfortable and sometimes uncomfortable, of course! What about the third question? Is your work in any way seriously constrained by this, what you would like to do?

(*Dr Evans*) As I say, the problem does not arise in the Department in relation to these rules.

526. You suffer no reduction?

(*Dr Evans*) No. We have not been arguing in the European Community for very large increases in the energy expenditure and hence the problem has not arisen in that context.

527. So it has really been a matter of defending, in a sense, what you had already achieved before?

(*Dr Evans*) That is the context of the discussions.

528. That is the subject of the Treasury attribution?

(*Dr Evans*) That is right.

(*Dr Walker*) Could I add on that that clearly there is a desire, not solely within the Treasury but within Government generally, that the same work should not be paid for within Europe as in the United Kingdom, so that obviously there is a constraint. Were I to go and propose to Government that they should build a new Tokamak, for instance, I would be told by the Treasury there is already one paid for by the Commission, so clearly one would expect the existence and nature of Community programmes to influence the existence and nature of domestic programmes. So there ought to be an interaction between them. It is not entirely wrong.

Lord Sherfield

529. You would not disagree, would you, that the result of the system is inflexibility?

(*Dr Walker*) I think any conflict of resources and competing demands for resources brings a certain degree of inflexibility.

(*Dr Evans*) Might I add that I have some experience of Germany in that I spent three years as Scientific Attache in our Embassy in Germany, and although they do not have the same kind of systems for budgetary control of European R&D activities, it was still necessary for the Research Ministry in Germany to have to discuss proposals for Community expenditure with their Finance Ministry and ultimately get their agreement to the resources being spent. So those discussions had to be carried out and would in any system have to be carried out, I think, for the reasons that Timothy Walker has already said.

(*Dr Walker*) I can also confirm that is true of France as well.

Chairman] Thank you very much, Dr Evans and Dr Walker, for your evidence. It has been very helpful.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE
SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
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Thursday 22 November 1990

SCIENCE POLICY RESEARCH UNIT

Mrs M L Sharp, Mr K Guy and Mr B R Martin

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THURSDAY 22 NOVEMBER 1990

Present:

Carver, L. (Chairman)	Nelson of Stafford, L.
Dainton, L.	Nicol, B.
Flowers, L.	Shackleton, L.
Kirkwood, L.	Sherfield, L.
Lewis of Newnham, L.	

Examination of Witnesses

MRS M L SHARP, Leader, DRC Innovation Group, MR KEN GUY, Leader, Evaluation of Government and Industry Strategies for Technology Group, and MR BEN R MARTIN, Leader, Science Policy and Research Evaluation Group, Science Policy Research Unit, called in and examined.

Chairman

530. Good afternoon, Mrs Sharp. We are very grateful to you and your colleagues for coming to give evidence to us this afternoon. You can see from our name plates who we are, but you may not know our specialist advisers Professor Roger Williams and Dr Mick Lomer. If you would like to introduce yourselves and make any opening statement about the subject generally we would be grateful if you would do so.

(*Mrs Sharp*) Thank you very much, my Lord Chairman. Can I say how grateful we are to you for asking us here. I am Margaret Sharp, and I am the Senior Research Fellow at the Science Policy Research Unit. My own field of specialisation has been on technology rather than on science policy. I have done a certain amount of work, as far as the UK is concerned, in looking at collaboration in science, but have not done any specific work looking at international collaboration at the nitty-gritty coalface level, but quite a lot of work looking at what has been happening in Europe. On my right is Ken Guy—he will introduce himself—and on my left is Ben Martin, who are both Senior Research Fellows at our institute. We would like to start by making three points in relation to your brief. First of all, as I think you yourselves are probably very well aware by now from the work you have done looking at the issue of international collaboration, we would stress that collaboration, comes in all sizes, shapes and varieties. Our own feelings are that the best collaborations are those that grow naturally from underneath, rather than those that are forced. It is, therefore, very important to look not just at the multi-national collaborations, which I think are the focus of what you are looking at at the moment, but to think also about bi-national collaborations which can sometimes be very important and, for that matter, the whole process of collaboration and networking within one country. One needs to consider at the whole range of collaborations when one is looking at this issue. Secondly, I think it is important that, in looking at this issue of international collaboration, to recognise that many of the collaborations that exist have grown out of what have been fairly deep cultural roots that have grown over the course of time. If you look at the spatial pattern of collaborations they often reflect old cultural and geo-political links. What we feel is important here to stress that governments cannot create collaborations; they do better to build on existing links and help nurture those links that are

promising. Sometimes, rather than trying to force multi-national collaboration, either national collaboration (that is collaboration within a national framework) or even bi-national collaboration may be just as good as trying to force the pace in terms of multi-national collaborations. Lastly, we think it is important to stress the fact that we do not see collaboration as a zero sum gain. Sometimes some of the writings on this issue have indicated there are gains for some and losses for others. Good collaborations should actually end up with there being many gainers. We think it can be so and that is wrong to look at it as a zero sum gain.

Having said that, I would like to pass over, if I may, to my colleague, Ken Guy, just for him briefly to introduce himself, and then Ben Martin will do the same.

(*Mr Guy*) As Margaret has said, I am a Senior Fellow at the Science Policy Research Unit. Over the past decade or so my main interest has been in the evaluation of Government technology programmes rather than science programmes, particularly collaborative R&D programmes. Since the early 1980s, in conjunction with a group at Manchester University, we have been evaluating the Alvey programme in information technology in this country, and are currently evaluating the Swedish programme of a similar nature, the Joint Council Cognitive Science and Human Computer Interaction Initiative in this country, and also advising the European Court of Auditors on their evaluation of the Esprit programme, the international collaborative R&D programme. I would like to make one point which perhaps Margaret did not touch on in her opening remarks: I would like to know if your remit extends to looking at technology programmes as well as science programmes. I do not think nowadays we can consider international science programmes in isolation from international technology programmes, given developments over the 1980s.

(*Mr Martin*) I am Ben Martin and I work in the group called Science Policy and Research Evaluation within SPRU, and this is the group concerned primarily with policies for the more basic sciences as opposed to technology and innovation, which is the bulk of SPRU's work. Our studies, which have been going on now for 10 or 12 years, have involved evaluation of one form or another, looking at scientific outputs from, in particular, big science laboratories, and in the course of that we were involved in looking at a particular example of an

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[Continued

[Chairman Contd]

international scientific programme, namely the CERN particle physics laboratory. There are some lessons which come from that study which relate to some of the questions you sent us.

531. A good deal of the evidence we have received has suggested that as a nation we do not handle international collaboration in science as well as some other countries, notably France and Germany. I wonder if you have views about whether that is a valid criticism? It has centred a certain amount on the long time it takes to get an answer out of the governmental machine as to whether an international collaborative programme is going to be supported or not. On the other hand, we are very seldom seen to initiate these programmes ourselves, we wait until somebody else has and then wonder whether we will join or not. Do you think those criticisms are valid?

(Mr Martin) One of the differences between Britain and the two other countries you mentioned, France and Germany, is that they do have a slightly more centralised approach to international collaboration. In France it is channelled through the Ministry of Research and Technology (although it is the Ministry of Foreign Affairs which actually pays the international subscriptions), and likewise in Germany it is the BMFT which plays a central role. In Britain we have a much more decentralised decision-making process which does add to the delays and complications, and maybe that accounts for British scientists being a little less enthusiastic about setting plans for international scientific programmes in motion. But this may get into the argument about whether a Ministry for Science or some cross-cutting agency for science and technology, not necessarily of ministerial status, should be developed in Britain. I am not sure that is an argument you want to get into here. It is certainly a problem we have encountered with some of these examples of international scientific programmes.

532. Do you think, therefore, a degree of criticism is valid?

(Mr Martin) I think it is. I think part of the problem, you see, is that at present we have no option but to make decisions on a field by field basis. The scientists in one community will come up with a proposal which will go to their research council and there will be a yes or no decision. We have no way of making trade-offs across fields, as you can do if at some point in the machinery everything is brought together. I think they do do an element of that in France and Germany and we are missing out to some extent there.

Lord Flowers

533. Without wishing to push you into a full blooded discussion of minister or not minister, is it your opinion, yes or no, that if we had a Minister for

Science with some central responsibilities for getting policies agreed to we would be able to handle international scientific policies better?

(Mr Martin) A simple answer, yes, although it would take much longer to justify. I think there would be benefits.

Lord Nelson of Stafford

534. What is the role of SPRU in relation to international collaborative programmes?

(Mr Guy) We sometimes act as evaluators of such programmes. We sometimes act in the role of advisers.

535. On behalf of?

(Mr Guy) Various government departments or, for example, the Commission.

536. But only sometimes?

(Mr Guy) Not invariably, there is competition.

537. When they think it is desirable, or when you think it is desirable?

(Mr Guy) A little bit of both!

(Mrs Sharp) We also hold a general watching brief over what is going on both in Europe and internationally in science policy, and in this sense part of our role at SPRU is to maintain a capability to critique what is happening internationally. In that sense we do try to get involved in evaluation procedures because the experience is very useful from the point of view of acquiring knowledge and competence.

538. This is important because one of the weaknesses that seems to come out is that there does not seem to be any oversight of our international activities. It is all rather ad hoc according to individuals or departments?

(Mrs Sharp) Yes, I think this comes back to the point Ben made, because responsibilities are split, and often split not just between the DTI and Education and Science but often in the agricultural programmes, with MAFF, and health programmes with the Department of Health. You have got split responsibilities here. Whereas in countries such as France and Germany, where there is a single ministry for science and technology, it is an easier process to co-ordinate activities.

Lord Flowers

539. But it is true so far as SPRU is concerned, is it not, that your core funding is not sufficiently adequate? You can set yourselves up as a general critic of international programmes but you have to wait for somebody to ask you to do something and offer to fund you?

(Mrs Sharp) Yes. Roughly 75 per cent. of our funding comes from contract research, and 25 per cent. is UFC funding and paid for by teaching

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[Continued]

[Lord Flowers *Contd*]

activities. Amongst that 75 per cent. is a degree of core funding from the ESRC but that amounts to rather less than 10 per cent. The answer is that we try to keep a general watching brief but in order to do so we actually need to be able to take on contracts which feed our stock of knowledge.

540. I should confess that some years ago now I told their Vice Chancellor that he ought to spend more on core funding of SPRU, but I do not know whether he ever did.

(*Mrs Sharp*) We have seen some increases!

Chairman

541. The body which is supposed to be providing this co-ordinating and overall look as far as major programmes are concerned is the Science and Technology Secretariat in the Cabinet Office under the Chief Scientist, with whom no doubt you have fairly close links?

(*Mrs Sharp*) Yes.

542. Do you get the impression that it is doing the job it is supposed to be doing well, or that there is a failure in that area?

(*Mrs Sharp*) Perhaps I can come in on that briefly. It seems to me that there are two problems that it faces. One is resources. It is actually substantially under-resourced for keeping any major watching brief. Secondly, it has only been taking this broad watching brief it has for about two years, since the re-organisation into ACOST from the old ACARD. Admittedly, ACARD took a certain number of subjects and then looked in detail at those, but it did not maintain a watching brief. There has been an international committee of ACOST of which our Director, Geoff Oldham, is the chairman. That has only been at work for the last two years and, therefore, has not really had time to get to grips with this sort of issue. The problem of under-resourcing is a fundamental one.

543. What part do you see ABRC playing in all this?

(*Mrs Sharp*) In time maybe ABRC could play a more substantial role but, once again, we have seen re-organisation, with more substantial executive powers being given to ABRC in the last year. It has yet to grow into that role. The problem I think of co-ordinating the research councils within the national framework, let alone to do it at an international level, is one it is still grappling with.

544. Perhaps we could turn to the question of the balance between national and international programmes. Certainly in other studies we have done you tend to say to us that it is important to go into an international programme because you could not afford the resources to go into it on your own. Then you are also told that it is terribly important if you are going into an international programme to

have strong national programmes. It is obviously a balance in resources between the two. Would you like to make some comments on that issue. CERN, for instance, does not have a national programme. In fact, CERN is our national programme in that field. In certain other fields all our international collaboration comes from our national programme. Is there some principle which ought to guide us on this?

(*Mr Martin*) CERN is an interesting example, although probably a rather extreme one, in terms of costs and degree of centralisation. When CERN was established there were at that stage quite well developed national programmes in Britain, France, Germany and Italy, and CERN was put forward largely in terms of cost sharing; that by doing things jointly we could build accelerators on the same scale as the Americans, which were at that stage too expensive even for the richer members of Europe to afford. A few years after that the people involved with CERN began to put forward very ambitious plans for expanding the national programmes, the argument being that you needed a triangle of effort, with CERN at the top and strong national programmes. Some of these plans involved doubling or tripling the size of the national effort but that was quickly squashed by some of the governments who said, "Well, you can't on the one hand tell us this is going to lead to cost savings and then a few years later come back and say you want ambitious national programmes". With the exception of Germany, those national programmes have now largely withered away. There you have an example of a highly successful scientific programme operating largely in the absence of a national experimental programme. There are national theoretical efforts and there are obviously experimenters in British universities but they go off to CERN or the German or American laboratories to do their experiments. You clearly can have an international programme with very little in the way of a national operation.

Lord Lewis of Newnham

545. Do you see any difficulties with this particular procedure whereby all the work now must be done, if I understand it correctly, in CERN?

(*Mr Martin*) Not quite all,—there are one or two alternatives. CERN is the main option but British experimentalists in this field can also go to the German national laboratory which is, in fact, open to outside countries, or they can go to one of the American laboratories. There are various options around. There are certain problems here, one of these (and this relates to one of your questions about the role of peer review) is that peer review has worked very successfully in the 20 or 30 years since the end of the second world war. It works well when you have lots of small groups competing for funds. If one group is asked to comment upon the proposal from another group it makes very little difference whether they say yes or no to their own chances of

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[Continued

[Lord Lewis of Newnham *Contd*]

getting funds. In a big science like high energy physics, who do you go to for your neutral peers? Most of them will either be using CERN, and if it is a proposal from CERN they will say, "This is a good idea", or they are a user of a rival laboratory who might therefore benefit if there is more money left in the pot by turning down this particular proposal. Certainly it causes problems in relation to the peer review process if that is your main mechanism for making decisions on these international programmes.

Lord Flowers] Could I just make a comment? Mr Martin knows the CERN operations very well indeed, and I am sure he did not mean to mislead us in any way but it is of course perfectly true that, with the exception of Germany, there are in Europe only international machines. These are machines at which national groups mount programmes in an international framework, very often with teams from other countries as partners, but it would be quite incorrect to give the impression there is no national effort going into it. The amount of British money spent in this country on the mounting of experiments at CERN and on their analysis thereafter and all of that is huge. It is not just an international programme and nothing else, by any means.

Lord Dainton

546. And it is quite widely distributed between, on the one hand, the Rutherford-Appleton laboratory and universities like Liverpool.

(*Mr Martin*) My point is that those national expenditures would not operate if CERN were to be closed tomorrow; they are on the back of the CERN programme; they are part of that international effort.

547. Or on the back of LEP?

(*Mr Martin*) There are another two or three laboratories which are open to British scientists in this field.

Lord Lewis of Newnham

548. This was the point I was trying to get to. If we were to take your model you imply that all the work was done at CERN and very little done over here. If one looks at Germany and France and compare this with the UK, and the actual mounting of programmes; if I understand you correctly, it is much easier in France and Germany because people are not necessarily committed to university lecturing programmes. In the UK in contrast it would require very much more time being spent at the particular site with teaching problems in the respective university. Do you see any problems with this area?

(*Mr Martin*) I am not sure of the current situation. The study we did was a few years ago. I know one change which has taken place since then has been a big expansion in the number of contract researchers—post-doctoral fellows—in British universities, so it is possible that the problem may now

be less severe because those people do not have a teaching commitment like tenured or permanent university faculty.

Lord Dainton

549. It is very demanding if you are in a physics department and involved in a big experiment and one has to constantly go to other places, at other people's convenience, and it does interfere with the teaching at your own university, but by and large the nuclear physics industry have coped with this and the concentration of nuclear physics has helped to make that possible. Is that fair comment?

(*Mr Martin*) Yes, I think it is. I was not giving this example as advocating this should be a model for everything—I was saying this is an extreme case. Our main position is that there are many different models of international collaboration, of which CERN represents one, and one which in my view is a highly successful centre but which took 15 or 20 years to learn how to operate efficiently. The DESY laboratory in Germany, which is essentially one country providing a host site for outside visitors from many other countries, learnt how to operate efficiently rather more quickly. One of the things which came out of our study of CERN is that throughout the '60s and '70s, when there was a number of major discoveries in the field, all but one of them was made in the States on very similar machines; and when we asked the researchers the reasons for it, they pointed to the difficulties of learning how to operate a facility where there are a dozen member states all wanting to be represented on the committees, and those committees taking a rather longer time to process proposals and making rather more conservative decisions. And there were specific examples where a proposal did not get through the CERN system but did get through the American system which was more flexible. It was only after 15 or 20 years they learnt how to do this effectively and at that stage began to make more bold, risky decisions, such as the one to close down the new Super Proton Synchrotron, sacrificing a year's experimentation, and set up the proton antiproton collider, which at the time was regarded as a very risky decision but which actually paid off.

Chairman

550. Is it not a mistake to think of national programmes and participating in international programmes separately, competing with each other? Are we chasing a hare here? That in fact one's participation in an international programme is in fact part of one's national programme?

(*Mrs Sharp*) Yes, I think that would be the right way to look at it, and it is very important to recognise the complementarities here. In fact in order to get the most out of collaboration you actually have to have a fairly strong programme to help to assimilate the fruits of that collaboration.

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[Continued]

[Chairman Contd]

551. Certainly when we were studying space and also more recently in the field of astronomy, it was suggested to us there is not a strong enough national programme to back our participation in the international ones, and this therefore is a form of brain-drain—we are subsidising in a way the other people. Is that a valid point of view?

(*Mr Martin*) In the case of astronomy, I believe the next speaker will be talking about that. It is an interesting case because for many years British astronomers largely preferred to operate a national programme rather than an international one. For example, Britain did not become one of the original members of the European Southern Observatory. They did enter into a joint approach with Australia but did not get involved in the multinational collaboration within Europe. The interesting thing is that during that period, there were some very prominent and capable observational astronomers who got fed up with the national programme and limited facilities, the biggest of which was the Isaac Newton telescope in Sussex, and went off to the United States where many of them have since stayed. In other words, there was a brain-drain going on which might have been less pronounced if we had become plugged into the international collaboration at an earlier stage.

(*Mrs Sharp*) It is very important to see international collaboration as being part of the cross-fertilisation of ideas which comes in science anyhow, from the mixing of communities and this sort of thing. In that sense we would be very much the poorer if we did not participate in some of these programmes. On the issue of the brain-drain, there are other factors affecting it, which will be there anyhow, irrespective of the international programmes.

Lord Kirkwood

552. Is there evidence of a brain-drain to Europe as a result of salary differentials or because of a viable base not being established in this country?

(*Mr Guy*) There are some signs in areas like information technology of us starting to get the beginnings of a drain of R&D people. It reflects more the crumbling of the industrial base in this country rather than anything else.

(*Mrs Sharp*) In biotechnology, which is the field I know more about, there is some evidence that a number of laboratories which have been set up in France, where they do not have a sufficient number of trained people internally to man their laboratories, are pulling in a very large number of Britons. I think we would expect to see that with the coming of 1992; mobility is going to increase.

553. Is that the attraction of the facilities which are available or are these salary differentials?

(*Mrs Sharp*) I think it is the three things: facilities, salaries and the type of post—very the frequently

offered do not involve teaching and administrative responsibilities which people in universities currently have to bear.

Lord Dainton

554. You did mention right at the beginning you saw the best kind of collaboration is that which is in a sense self-chosen by the working scientists. Bottom-up. That is a free association?

(*Mrs Sharp*) Yes.

555. It hardly forms part of a programme but may take advantage of, for example, the Framework Programme, that sort of thing. Leaving that out of consideration, I would like to put it aside and turn to these larger programmes.

I would like to know whether you think it is true and whether there are any real differences between them. There are two other different kinds of programmes, one is represented archetypally by CERN, where the programme itself is predetermined by international discussion, as well as by international subscriptions, and then there are other places like ILL in which they are set up internationally but the work that is done is very often determined by scientists from their own individual countries doing what they want; they are a kind of research hotel. Is there any difference in performance between the two? Finally, are there different ways in which these should be managed that we should know about?

(*Mrs Sharp*) I personally do not know enough about these two different styles to answer that question. Ben, do you have any views on this?

(*Mr Martin*) Only to a limited extent because I am not sufficiently familiar with ILL. There was one occasion, and this relates to the question which came up earlier, when we were approached in a very tentative manner about possibly looking at ILL and evaluating how well that was performing scientifically and otherwise, but that never came to anything. I think you have perhaps slightly exaggerated the difference between the two, in that CERN is not completely a laboratory with a centrally determined research programme. They are still responding to the individual proposals from groups of researchers and a policy emerges by choosing some of these and not others and combining some and so on.

556. You would agree that a lot of work is now pre-determined for years ahead because the experiments are so long-lived?

(*Mr Martin*) That is certainly the case, particularly as you move increasingly towards colliders where there are only a number of experiments which you can do on them. Again, those involved in those experiments would say that they had come up from the bottom, as it were, and you still have competition between the performing groups, rather than being determined centrally and then imposed downwards on the research community. I do not think too much should be made of the difference in that case.

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[Continued

[Lord Dainton *Contd*]

(*Mr Guy*) Can I offer some lessons from the experience of collaborative R&D programmes of the type of Alvey, where we found generally that projects which were researcher-driven—where researchers suggested the projects, got on with the projects, and were left alone sometimes by senior management and the directorate to get on with the projects—produced excellent technical results. We found that the projects which were put together right from the top by the directorate were often unhappy marriages which rarely achieved very good technical outputs. We found though that the projects which really went somewhere in terms of moving from research to development and into production feel into neither of those two categories. They were the ones generally formulated by the business divisions in companies in conjunction with researchers. The researchers did not do what they wanted to do entirely, they did not do exactly what the directorate wanted them to do but they did what the business units wanted them to do. Those were the ones which were successful in terms of reaching the developmental and production stages.

Lord Dainton] Doing it rapidly and efficiently.

Chairman

557. I am sure you are aware of the Cabinet Office guidelines which have been issued. How easy do you think it is to judge whether those guidelines can be met, in particular as to whether it is cost effective from the national point of view to engage in co-operation, or whether it might not be better to stick to a national programme or a bilateral one. Do you think that it is possible to come to a sensible judgement on this, and that on the whole the right decisions are taken?

(*Mr Guy*) I think we would argue strongly against the sole use of cost effectiveness as a measure of whether one should participate in international or national programmes, on two main grounds: one, most of the outputs of these programmes are tacit in nature and very hard to quantify and, therefore, it is very hard to get any effectiveness statement at the end of the day; two, we would say that between national and international you cannot really regard them as separate entities. It is not an 'either or' decision. They are usually related to each other in some way. If they run in parallel there is sometimes a symbiotic relationship; sometimes, unfortunately, an overlapping duplication. Other times, when they run sequentially, national programmes act as a valid entry ticket into the international ones. It is not a case of looking at which is most cost effective, they have to be considered in conjunction and with a lot of other criteria in there other than just cost effectiveness.

558. Who do you think should take the decision as to whether or not we should join an international collaboration?

(*Mr Guy*) That would very much depend on the type of international collaboration that one is

concerned with. I can talk on the technology end and Ben can come in on the science end. If you are talking about a pre-competitive R&D programme in something like information technology it has to be arrived at via a consensus, looking at the participants, scientists, industrialists and the various departmental officials involved at national and international Community levels. It has to be an iterative process involving as many of the participants as possible to try and sort out the various aims. Without that consensus, at the end of the day these programmes tend to wander off in all directions rather than go in the ways that the participants would like them to go.

559. In your view where it is within a single research council, say, SERC, do you feel the right decisions are made there, leaving aside the ones that have to go up above the research council itself?

(*Mr Guy*) I think we have actually started making some progress over the last ten years or so in, for example, the SERC-DTI joint information technology advisory board committee structure. That is a distinct improvement and allows the research councils and the DTI to get together and make decisions jointly. That did not exist in the early 80s. We have seen that improvement. I feel sure that we are going to have to see other arrangements like that in other technical areas.

(*Mr Martin*) Perhaps I can come to the science end of the spectrum and in particular draw upon the results of some work done in the States on the factors affecting international scientific collaboration there. They have looked at the factors and in addition they have identified different types of policy questions which have to be addressed. This comes back to what my colleagues were saying about cost effectiveness being too narrow and too limited. They say that there are essentially four different types of issue which you have to think about. First of all, there is a choice of area that you are going to engage in in international collaboration, and that will depend on your own national strengths or weaknesses, other countries national strengths and weaknesses and what other countries' priorities are. Secondly, there is the choice of partners. Here some of the criteria are: are the partners at a similar sort of level of scientific development? Because if there is an imbalance between the two, after a while this will probably give rise to some sense of dissatisfaction because the flows of benefits are mainly in one direction. Other factors are: are these partners going to be reliable? I am afraid in some European countries you will find the criticism that Britain has not been a very reliable partner in some instances. The third thing is the type of organisational mechanism. We were discussing this earlier. Should it be a big multi-national one or should it be a bi-national one? Lastly, there is the choice of funding arrangement. There is a much wider range of questions and criteria that have to be taken into account.

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[Continued]

[Chairman Contd]

560. Can we turn now to the European framework programme. We have heard several complaints that the Treasury's attribution system leads to the problem, in some cases, of under-estimating inflation and problems of foreign exchange, but also generally as programmes develop that there have been serious cases of it affecting the resources available for domestic programmes.

Have you found evidence of this, or is it what people should fear in the future rather more than what has happened already?

(*Mr Martin*) It has certainly caused problems in the past, I know, in relation to the subscriptions of CERN and the other big subscriptions SERC has to pay. Again in other countries they say "This is silly, why should unforeseeable fluctuations in exchange rates mean there is less money left at SERC for national programmes?" Maybe a mistake was made in the past when SERC benefitted from these fluctuations and pocketed the money and afterwards the Treasury decided they could not have their cake and eat it and in future they should bear the losses as well as the benefits. If that was the origin, it was a mistake, and the sooner it is rectified the better, because it does give rise to this problem of national programmes suffering more than international programmes, and that should not happen. You should have the mechanism to avoid that happening.

Lord Nelson of Stafford

561. How would you see that being changed? Or how would you like to see it changed?

(*Mr Martin*) The only option is to take the international subscriptions out of individual research council budgets, as they do in France, where it is paid by the Ministry of Research and in Germany by BMFT rather than by the CNRS in France or Deutsche Forschungsgemeinschaft in Germany.

562. We have no mechanism for doing that because we have no ministry.

(*Mrs Sharp*) It could go on to the DTI budget or the DES budget.

(*Mr Martin*) I think in France it is the Ministry of Foreign Affairs which actually pays it.

(*Mrs Sharp*) I think it is too.

(*Mr Martin*) So it could come to the Foreign Office.

Chairman

563. Surely that would not make any difference, trading it, because you still have to make provision for it. It is not going to come off teachers' pay!

(*Mrs Sharp*) As long as you do not take account of variations in the exchange rate, it makes no difference at all. Somebody has to take the cut somewhere. The question is whether the cut is taken by the other researchers, out of their budget grants, which is happening at the moment. When the exchange rate provision of the CERN budget

becomes a bigger item, there is less money elsewhere in SERC. The same would be true more generally of the Foreign Office or the DES.

564. I cannot understand how you spread it across. I can see how you can work something like in the easier days of the Ministry of Defence when you were allowed price increases—you have your budget and if there were pay and price increases during the year you were able to say, "I need more money to cover these."

(*Mr Martin*) The problem is the short term fluctuations. At the start of the financial year some fairly rational decision is made about the balance between national and international efforts which people are willing to accept, but then the problem comes a few months later when some exchange rate alteration means suddenly there is less money left for national programmes. If people had known that in advance, they would not have struck the same balance between the two. So, yes, every year—or, ideally, one should move more to a multi year budgeting system—but at periodic intervals you have to put the two together and ask the question, is this a proper balance between the two. But between that period of looking at it and the next one, if there are these currency fluctuations, the national effort should not be expected to pick up the difference.

Lord Flowers

565. There are really only two relatively minor issues which push you in the direction of the Foreign Office. One is the exchange rate fall, which is a very technical matter and if the Treasury invented a sensible rule we might get around that, except they do not want to. The other is the undoubted fact there is some Foreign Office consideration in British scientists joining an international project. It is hardly a large issue for the Foreign Office but it is an important issue, and set up the way we are, it is not easy to get that foreign policy element into British science, but it is not in CERN and the Foreign Office plays a full part in determining the British attitude to CERN. I would be very interested in your comments on this. It does seem to me the argument for putting the responsibility for international science on the Foreign Office, as they do in France, has been a good one.

(*Mr Martin*) To take the example of France again, I think I am right in saying even though it is administered by the Ministry of Foreign Affairs it still bears on the civil research budget for which the Ministry of Research and Technology is responsible; money which then goes to the different departments with research responsibilities. So at a certain point in the decision-making process, presumably every year or so, there is some attempt to make these judgments between national and international efforts, even though it is then administered by the Ministry of Foreign Affairs.

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[Continued]

Lord Dainton

566. Even if there were no fluctuations of exchange rates, the principle of attributions in this country does create a problem, does it not, because that places an envelope around a field of activity, whether it is engaged in overseas or at home? How do you react to that particular problem which can have in principle quite a large disbenefit, particularly on small contracts which would be affected by a reduction at research councils of money in particular areas?

(*Mrs Sharp*) I think that, as you rightly suggest on this issue, somebody's budget really has to bear the cost of it, and it is in the end slightly arbitrary as to who bears it.

567. But the effect is to provide a disincentive for British scientists to be successful in international competition or international activities?

(*Mr Martin*) Yes, we would agree with that entirely, and again European researchers who we talk to say, "This is crazy, that the British scientists", who they admit are amongst the best in that particular area, "are being penalised for their success". And they think this is crazy particularly given a Government philosophy that those who are stronger should in some way or other get the benefits. They clearly are not benefitting in this particular case.

568. Have you any suggestions as to how this position might be rectified?

(*Mr Martin*) The implication of what I have just said is that I do not think the notion of attribution should apply, certainly in the case of more basic areas of research. There may be more argument for the more applied areas but for basic research I do not think this is the right way forward.

569. If one was a young scientist being penalised in this country, the obvious thing is to go to Europe?

(*Mr Martin*) Yes, and that then opens up interesting questions as to what will happen after 1992.

570. That is the question I was coming to.

(*Mr Martin*) Okay. There seems to be an assumption running through some of the questions we were given that international scientific collaboration in many cases implied European collaboration as organised through the EEC. I would see that as not necessarily a particularly desirable way to go. It would involve too much concentration of resources which in turn might lead to more bureaucracy, slow decisions and so on. One option which could be explored perhaps internationally, on an experimental basis, is to have British research councils open their doors to scientists from one or two countries initially—maybe the Netherlands, Germany, whatever—if they in return opened their research councils to British scientists for their proposals. That would

then provide a means for these British scientists, who for one reason or another fail to get money in Britain, to go and try elsewhere. If they are as good as they say they are, they should do well from such a system. In addition, I would have thought it was a mechanism which suited this Government's philosophy about the free market rather than centralised bureaucracy in Brussels. I do not think it should be done dramatically over night but on a small scale as an experiment and, if it works, then gradually extend it from that to bring in other European countries.

Chairman

571. Arising out of that, would you like to comment on whether the European Framework Programme and the fact we are so committed to that in many ways, although it is a limited field, has any serious effect on collaboration elsewhere, particularly the United States or Japan?

(*Mr Martin*) At that point I would bring up some other work which has been done recently, looking at the pattern of international collaboration, again in the more basic areas of science. This shows international collaboration has been growing quite rapidly over the last 10 or 15 years so that something like 15 per cent of scientific papers involve international collaboration.

During that time obviously you have had the European Commission assuming an increasing role—it perhaps has doubled over that timescale. Collaboration between one European country and another has grown no faster than that between one European country and a non-European country, often the United States although now perhaps the East European countries are coming in. That goes back to the point made by my colleague, Margaret Sharp, earlier that Government policies cannot force collaboration to emerge from nothing; all it can do is build upon existing links. Another part of that work I referred to involves analysing and mapping out patterns of international links—that is, it is drawn on maps, as it were, and if two countries work a lot together they are very close together on the map and if they do not they are further apart on the map. The astonishing thing about this is that the maps look particularly like geographic maps—in other words, it is historical and cultural factors which are most important in shaping international links rather than where are the best scientists around the world to collaborate with. The European Commission cannot force international collaboration to happen—all they are able to do is build on existing links.

Lord Dainton] In the third Framework Programme, if I have understood it correctly, I understand one of the objectives of that programme would be to promote social cohesiveness and to do this they are proposing establishing, I think it is 5,000 or some such, large number of fellowships which will be available throughout Europe. Do you regard that as a wise means of ensuring good scientific work and co-operation? What does it mean?

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[Continued

[Chairman *Contd*]

Chairman] I think the second question should have come first.

Lord Dainton

572. Am I correct in this?

(*Mrs Sharp*) No. What is known as Stimulation part of the Framework Programme, this is in fact a minor part of it. I think part of the idea lying under this notion of social cohesiveness is actually, if you like, European cohesiveness. You ask: "is it a good idea?", I think it is a thoroughly good idea. At Sussex we run a programme which is called the Science and Europe Programme and we have been doing it now for about 12 years. It started with a few students who took in addition to their ordinary three-year science course, an extra year to learn the language and spending time in France, Germany or Italy. This has now grown to about 70 students who spend their third year studying physics, chemistry or biology at a university in that country. When they come back, they are European as well as being Britons. They think "European" in a way they did not before they went. They are part of a new generation of young people whose horizons are very much broader than our's at an equivalent age used to be. I think it is of vital importance that these programmes engage international exchange, both at the student level and perhaps particularly at post-graduate and post-doctorate levels. This is an important part of the European effort in basic science. I would be sad to see the Commission taking over much more of what are at the moment national science programmes. I think the appropriate level for the distribution of research grants for basic science is probably the national level, rather than the European level. There are great dangers of too much concentration. I support the premise that pluralism in basic science is a good thing.

573. I accept everything you say about the under-graduate levels but with the post-graduate levels I am worried that the criterion of choice and selection might introduce an element which is not of that good a science quality, either on the individual or the level proposed. Do you think there is a danger of that?

(*Mrs Sharp*) I do not know enough about this particular programme or what they are proposing to do, or what the objectives are. Certainly in relation to programmes I have seen in the biotechnology area, all the proposals that come forward are peer reviewed. Provided you have mechanisms of this sort, for making sure that good science is being pursued, then that is fine. I do not know whether this applies to this particular bit of the Framework Programme.

Lord Lewis of Newnham

574. I was just wondering, in relation to the other exciting programme which you have been mounting in Sussex, actually how far do people stay in this country having gone through these programmes, or how far do they go back to the country in which they took their third year course? Is there any increase in the translation of people from the UK to these countries? I find this interesting because sometimes one argues the real barrier for people going to Europe is the language barrier but I think you have surmounted that barrier.

(*Mrs Sharp*) I think we have surmounted that barrier. I would like to see this programme extended to many other areas of study. But there are other barriers. Let me give you an example: at the moment two students have come back and completed their degrees last year. They were over at Freiburg University and they want to go back and do their PhDs. The problem that arises at the moment is Freiburg will not accept the four year degree at Sussex as being equivalent to the Doktorarbeit which is required—rightly, because the doktorarbeit is a broader based programme. This is an issue which has to be sorted out in Europe given the Erasmus programmes. It illustrates the sort of problem that those who are currently administering the science in the European programme are trying to grapple with.

Chairman] On that upbeat note, thank you very much for the evidence which you and your colleagues have given, it has been most helpful. Thank you.

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[Continued

Memorandum by Professor Sir Robert Wilson, CBE, FRS

The Department of Physics and Astronomy at University College London is conducting research programmes in several areas of physics and astronomy which it believes lie at the forefront of the subjects. This claim is supported by the assignment of the highest rating to the Department in the UFC research assessment exercise of 1989. The programmes are also heavily internationalised with the nature and degree of international collaboration varying widely. These include institutionalised European agencies such as Centre Européen de la Recherche Nucléaire (CERN) and the European Space Agency (ESA), international collaborations such as the Anglo-Australian Observatory (AAO), the La Palma Observatory (LPO) and the James Clerk Maxwell Telescope (JCMT), *ad hoc* international projects such as the International Ultraviolet Explorer (IUE) and the Röntgen Satellite (ROSAT), access to facilities provided by other countries (German particle collider, HERA, US, Soviet and Japanese satellites), and research funded by the Stimulation-Action Programme of the European Community. It seemed clear, therefore, that a submission by the Department to the Sub-Committee of the House of Lords Select Committee on Scientific Programmes could be of value. This document presents the observations and comments of groups in five different areas, as follows:

- Elementary Particle Physics (Professor F W Bullock and Dr D J Miller).
- Ground-Based Astronomy (Dr A J Willis).
- Space Science (Professor J L Culhane, FRS).
- Atmospheric Physics (Dr D Rees).
- Positron Physics (Dr M Charlton).

The views expressed are those of each group as presented by the authors.

This Summary will be restricted to those comments and recommendations which are both major and common to the different groups. They will be listed under the headings as given in the letter of Mr R H Walters of June 1990.

(i) Advantages and Disadvantages of Joining ISPs

In the areas of research conducted by this Department (and, we believe, by the UK in general), it is essential to join ISPs in order to remain at the forefront of the subject because national resources are insufficient on their own. It should be added that such interactions probably have benefits, possibly not originally envisaged by the scientist, which lie beyond science. We therefore believe that the advantages of joining ISPs are overwhelming.

One disadvantage of major, multi-national ISPs seems to be a tendency to be less cost effective than national counterparts. Clearly, some increased cost must be incurred as the price of running a multi-national organisation, but separate reviews of CERN (Abragam) and the Science Programme of ESA (Pinkau) both concluded that significant cost savings could be made. The extent to which these are implemented will be a matter of interest for the future.

Other disadvantages of joining ISPs seem to stem mainly from the difficulties posed by the need to adjust national policies, resources and procedures so as to maximise the whole endeavour and the national returns from it. It is striking how different is the approach of different countries to this problem, particularly in respect of the institutionalised European agencies, CERN and ESA. Here, the main continental countries support a relatively much larger national programme than does the UK, on the grounds that this is the best way of exploiting and influencing the facility. The evidence indicates that they are right. The situation is exacerbated by the UK method of funding the programme (again, quite different from our partners) which is dealt with under (viii).

(ii) Advantages and Disadvantages of Hosting Large Facilities

We believe that there are major advantages to the host country in housing a large ISP. The advanced technology involved stimulates local industry, the science excites public interest and the presence of the facility can become a matter of national pride. Also, there is an economic benefit from the purchasing power of the staff employed and the visiting scientists.

The poor performance of the UK in winning the location of international science establishments that it subscribes to should be a matter of concern.

(viii) Impediments within the UK to Engaging in ISPs

One general comment can be made from the experience of involvement in a wide range of international collaborations—to have a successful ISP, it is essential for the participating countries to adopt a flexible approach and to be willing to modify national procedures for the benefit of the whole. There are some areas, addressed here, where it can be questioned whether the UK has been sufficiently flexible.

National subscriptions to the large ISPs, CERN and ESA are calculated by a formula depending on GNP and expressed in a particular currency. This means that the fluctuations in GNP and in exchange rates induce fluctuations in the subscriptions. The UK procedure for handling this is to leave the problem entirely with

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the funding body, in this case the SERC. Unfortunately, the SERC budget is not large enough to cope with these perturbations without severe disruption to the rest of its programme. Since it would be inequitable to impose the fluctuations on areas outside those concerned—particle physics and space science—it is not surprising that they have to carry the main burden. The result is that an increase in subscription results in a decrease in the corresponding national budget or, in other words, an increase in the UK contribution to the international facility results in a decrease in its ability to exploit that facility. This worsens the problem referred to in (i) above whereby the UK supports a national programme at a level relatively well below those of our main partners. Pushed to the limit, these policies will reduce the returns to the UK to the extent that it will be subsidising the science of others.

In other European countries, the subscriptions to CERN and ESA are not coupled to the basic science budget, but carried by a major department of state large enough to accommodate the fluctuations without damaging repercussions. We believe that the adoption of this policy by the UK would be beneficial to its science programme and also demonstrate its flexibility of approach to ISPs.

Other problems stem from the fact that UK salaries are significantly less than their continental counterparts. At the present time the consequences cannot be described as serious and are being contained, but there is a long-term danger, with the impending growth of EC funding and European institutions, that a net flow of UK scientists and engineers to the continent will result.

ELEMENTARY PARTICLE PHYSICS

Introduction

The group has extensive experience over more than 30 years of working in International Scientific Programmes. Group members have collaborated in programmes at Berkeley, Brookhaven, Fermilab and Michigan in the USA, as well as maintaining a continuing programme at CERN (Geneva) and, more recently, at DESY (Hamburg).

The following notes represent the collective experience of those currently participating in and, in some cases leading, University-based research teams working at the SPS Accelerator and the LEP Collider at CERN and the HERA Collider at DESY.

(i) Advantages and Disadvantages of Joining ISPs

The advantage of belonging to an International Organisation like CERN is very clear. The UK could not afford to participate in this aspect of frontier science without large scale International collaboration to provide the facilities, instrumentation and expertise to which access is essential if progress is to be made. British Universities have an excellent record of bringing data home for analysis and of developing new ideas in their own laboratories. The same advantages apply to the programme at DESY which, however, is a national laboratory to which the UK does not subscribe funds. Nevertheless, full participation in programmes at this laboratory requires the UK to provide its full share of funding for the instrumentation it uses.

Undergraduate and postgraduate students benefit because they feel they or their teachers are in direct touch with the frontiers of human knowledge—an important part of their motivation. University teaching also benefits because the staff are familiar with the latest instrumental, experimental and computing technology which can then be presented in lectures and incorporated in projects. This is a real, if seldom recognised, route for technology transfer from fundamental research fields via new graduates into industry and commerce.

UK industry can benefit (although it has been extremely reluctant to do so) through tendering for contracts on the advice of UK national institutions or simply by word of mouth recommendation from participating UK physicists. It can also benefit by virtue of the fact that UK scientists and technicians working in an international organisation become embedded in an environment where foreign industry is the main supplier. They see the products on offer and the style of marketing used and will transfer this knowledge when they return to the UK academic or industrial sector.

Workers with school age children who spend time at an international organisation have the very significant benefit of a direct comparison of educational standards and methods in the host country with those in the UK. This, regrettably, is not always to the advantage of the present UK educational system, but may be some small help in influencing future developments.

The main disadvantage is the necessity for some of the members of a research team to spend long coherent periods abroad. This is almost impossible for members of the permanent academic staff who must, in general, carry a full load of teaching. To make a full contribution to an international programme it is

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absolutely essential that the funding body provides dedicated staff (Research Fellows, etc.) who can maintain a presence at the site of the experiment. This necessity has been traditionally recognised by the SERC (the principal funding authority for Elementary Particle Physics) but the level of provision in this respect is now often too low for the UK to take leading positions in international programmes.

(ii) Advantages and Disadvantages of Hosting Large Facilities

The advantage of hosting large facilities are also fairly clear as can be seen from the experience of CERN. The regions of Switzerland and France around Geneva are developing a wide range of science-based industry, an important component of the great prosperity of the region and a direct result of the presence of CERN. Qualified electronic technicians and engineers commute up to 50 kilometres a day to work at the laboratory. There is a pool of well qualified contract technicians, who have moved to the district from all over Europe, available to CERN or to other local employers. Any high-technology ISP based in the UK would have a similar stimulating effect on the local region.

The presence of a large facility in the UK would bring an immediate and accessible benefit to schools and Universities which would feel closer to the forefront action. Also the awareness of the general public to scientific research would be considerably heightened. This can be seen very markedly in Geneva where visits to CERN are popular and frequent, and the general public has considerable pride in being host to a world-leading scientific laboratory.

(iii) The Setting up of International Programmes

From the point of view of Elementary Particle Physics, the machinery for instituting international programmes is well established and works well. Within the SERC there is a definite problem when a proposed ISP does not fall clearly within the boundaries of the pre-defined funding areas (e.g., Nuclear Physics Board, Science Board, etc). This has been an unsatisfactory aspect of the SERC for a very long time, and remains a problem in spite of much criticism. A recent example is the difficulty over funding the Sudbury Neutrino Observatory, in which project the UK could have taken a leading role. Internal dispute over whether it was an Elementary Particle Physics programme or an Astronomy programme eventually produced no more than "poor relation" status for the UK.

(iv) Technical and Financial Criteria for the Consideration of Proposals for ISPs

The present peer review mechanism, evolved over many years, works surprisingly well in the field of Elementary Particle Physics.

(v) The Forums in which the Decision to Participate in ISPs is Normally Reached

For Elementary Particle Physics, the only forums in which decisions are reached are the peer review committees. Each and every proposal is given full and fair consideration unless (iii) above is the case. The only criticism that might be made is that the peer reviewing process is too detailed with committees spending too much time on minutiae and too little on broad (and long-term) strategy.

(vi) and (vii) No comment.

(viii) Impediments within the UK to Engaging in ISPs

The CERN subscription is fixed by formula and is a first charge on the SERC budget for Nuclear Physics. This can generate serious strains whenever the pound weakens against the Swiss Franc. A small (few per cent) fluctuation in the subscription can produce a massive (perhaps 20 per cent) fluctuation in the amount left available to University laboratories. international subscriptions of this sort which depend so absolutely on the vagaries of international finance should be funded directly from the Treasury (who negotiated the method of subscribing in the first place). This would be in line with the practice in most other member states.

Travel and support funding for the participating groups comes from the remainder of the Nuclear Physics Board budget after funding the CERN subscription. This has been cut disproportionately over the last few years, leading to a situation in which groups from other countries, including non-member states, can spend more time in Geneva and participate more fully in the analysis and publication of results than can University-based UK researchers who have made an equal contribution to the construction of the experiments. Shortage of support funds may also make it difficult for UK groups to play their customary role in the conception and development of the accelerators and detectors for the next round of experiments.

The cost of living in Geneva (and in Hamburg) is high by UK standards. UK scientists on visits to CERN or DESY are supported at a reasonable, but by no means over-generous, level. Because UK salaries are significantly lower than many of our international collaborators, the marginal cost of keeping staff abroad rather than at home is somewhat higher for us. High travel and subsistence bills cannot be avoided if we are to benefit fully from our membership of ISPs.

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(ix) Impediments in Other Countries to Their Engaging in ISPs

Eastern bloc scientists have found ingenious ways of collaborating in ISPs in spite of the manifest difficulties. The UCL group has collaborated with Polish groups for more than two decades on various experiments using the nuclear emulsion technique with great success in spite of the fact that little or no financial support has been available to the Poles. The current "Westernisation" of the East will surely ease the way to international collaboration, something which will be unanimously welcomed by Elementary Particle Physicists in all ISPs.

GROUND-BASED ASTRONOMY

Introduction

UK ground-based optical, infra-red and milli-metre astronomy is primarily conducted at major observatories overseas which in many cases were constructed by the UK, but now mostly involve joint-funding through international collaboration. These are: the optical observatory on La Palma, Canary Islands (UK-Spain-Netherlands), the Anglo-Australian Observatory (AAO) at Epping, NSW (UK-Australia), the Infra-red Telescope (UKIRT) on Hawaii (UK), and the James Clerk Maxwell (JCMT) mm-wave telescope on Hawaii (UK-Netherlands-Canada). UK funding for participation in these observatories is determined annually through SERC and its Astronomy and Planetary Sciences Board. In addition to these overseas observatories there are two UK-based SERC establishments, the Royal Observatory Edinburgh (ROE) and the Royal Greenwich Observatory (RGO, now at Cambridge) which are respectively responsible for managing the Hawaiian and La Palma operations. In contrast the AAO is managed by a joint SERC-Australian AAT Board, and is fully operated by a team at the observatory site.

The Department of Physics and Astronomy at UCL is a major user of all the above overseas telescopes and has also designed and constructed major instruments for general use at each observatory. The Department has additionally provided the Chairman of the AAT Board and the JCMT Board, as well as membership of the different observatory's SERC Steering and User Committees, SERC Council, the APS Board and its sub-committees.

(i) Advantages and Disadvantages of Joining ISPs

The internationalisation of the UK's ground-based observatories on Hawaii, La Palma and in Australia, has provided a much-needed financial contribution for their continued operation and enhancement over the past decade or so during a decline in SERC funding for Astronomy (Note: the UK had to withdraw from its partnership with South Africa in the SAAO due to funding cutbacks). In addition, our international partners have assisted in instrumentation provision for these facilities. In the case of the Hawaii and LPO observatories, the addition of new funding partners has been accompanied by a pro-rata reduction in the amount of observing time available to UK-based astronomers (the AAT from its inception involved a 50:50 share in funding and time allocation between the UK and Australia).

Access to these major ground-based facilities keeps the UK at the forefront of this field and also provides excellent training for university research students in operating state-of-the-art equipment. Additionally, UK universities have had the capability of developing novel instrumentation for these telescopes, providing excellent postgraduate training in optical, electronic mechanical engineering and computer skills. At UCL this R&D has further led to the development and construction, in-house, of major instruments for general use at each observatory, including: the IPCS detector for the INT and WHT telescopes on La Palma, an infra-red spectrometer (CGS3) for UKIRT, and an echelle spectrograph for the AAT.

(ii) Advantages and Disadvantages of Hosting Large Facilities

While our main telescopes are physically located on excellent sites overseas, the UK does retain two, home-based SERC establishments—the Royal Greenwich Observatory (now at Cambridge) and the Royal Observatory Edinburgh, responsible for running the La Palma and Hawaii observatories respectively. RGO and ROE provide support astronomers and technical staff on the island sites and in addition, retain substantial teams in the UK for the provision of instrumentation for the overseas facilities. These arrangements are in place largely for historical reasons, and it is questionable whether they provide the most cost-effective method of operational support.

By contrast the AAO is run in a very different manner, in that all staff associated with the observatory are located on a site close to the facility in Australia (*viz* there is no UK-based establishment associated with it). There is no large instrumentation team at the AAO, rather its new instruments have generally been procured by the AAT Board from the most suitable source, often a university group. The AAT is generally regarded as one of the best equipped optical telescopes in the world. We believe that a move towards operating and managing the observatories on Hawaii and La Palma in the AAO-model would provide significant benefits to the UK, both in terms of cost savings, and in stimulating instrumentation technology in the Universities.

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(iii) The Setting up of International Programmes

International programmes in ground-based astronomy are generally set up by inter-agency discussions and negotiation between SERC/APSB and its counterparts overseas. Proposals for major new facilities may be initiated from individual scientists and the astronomical communities, but detailed discussions usually quickly involve SERC and one or more of its home-based establishments. An example here has been the recent proposals for the construction of new 8-m class optical-IR telescopes via international partnership either with Spain (on La Palma) or with the US and Canada on Hawaii/Chile. The UK can afford to be involved in only one of these projects, and the past year or so has seen intensive discussions as to which option to go for. Unfortunately this debate has become partially polarised by the fact that one SERC establishment (RGO) would be heavily involved in one option (the Spanish) and the other SERC establishment (ROE) would be heavily involved in the other (US-Canadian). We believe that scientific, technical and cost-factor considerations should have complete priority in reaching the final decision.

*(iv) Technical and Financial Criteria for the Consideration of Proposals for ISPs and**(v) The Forums in which the Decision to Participate in ISPs is Normally Reached*

Proposals for major, new capital projects are normally subjected to intensive Phase A studies to determine feasibility, technical readiness and costs. This is usually carried out by a team appointed by the APSB including international representatives when relevant. In general, the UK cost of participation in new ISPs have to lie within the envelope of the Forward Look of the APSB and its long-range planning. The chain of peer review within SERC is extensive and generally consists of (i) consideration by a scientific and technology Assessment Panel, (ii) the Ground-Based Programme Committee of the APSB, (iii) the APSB itself (which usually has to provide all the necessary funding), and SERC Council which gives the final approval within its delegated financial authority. This procedure can take two to four years (sometimes longer), and does not always match the approval timescales and mechanisms of potential overseas partners.

(vi) Government Practice and Guidelines on ISPs

Government practice on ISPs is handled through SERC, its officers and the APSB and its committees. In general the mechanisms and guidelines are well practised and understood throughout this peer review structure. Whilst Treasury rules regarding underindexation and currency fluctuations are understood, they are not considered beneficial to the UK astronomy programme.

*(vii) Treasury Rules of Additionality and Attribution and**(viii) Impediments Within the UK to Engaging in ISPs*

The main problems associated with the above are financial, in respect of currency fluctuations associated with UK costs of maintaining telescopes on overseas sites. In addition, current Government practice with regard to compensation for inflation has for many years involved significant underindexation which has a major adverse effect on the APSB programme which is so heavily weighted to international programmes and support of its SERC establishments.

The costs associated with currency fluctuations and underindexation must be accommodated within existing SERC/APSB funds, with little or no ability to carry forward from one year to the next in accordance with Treasury rules. In most years, currency fluctuations have an adverse effect, and with International Programmes usually protected in the Forward Looks of SERC and Boards, the funds available for the domestic programme and exploitation of the overseas facilities are reduced.

SPACE SCIENCE

Introduction

Starting with the US/UK Ariel I satellite, the first ever international collaborative project in Space Science which was launched in 1962, UCL groups have a long and distinguished record in the international arena. Particularly noteworthy successes were achieved with the US/UK X-ray Astronomy mission Ariel V (launched in 1974) which established the UK groups as world leaders in the field, with the US/UK/ESA International Ultra-violet Explorer (IUE, launched in 1978) which is one of the most successful space Astronomy missions ever flown and which continues in operation twelve years later and with the ESA Giotto mission to encounter Halley's Comet in 1985 which had on-board the very successful Plasma Analyser provided by the College's Mullard Space Science Laboratory (MSSL).

At present UCL research groups are analysing data from or providing instruments for more than 20 space missions. These cover a large number of Space Science activities including Atmospheric Physics, Earth Remote Sensing, Solar Physics, Space Astronomy (including IR, visible, UV and X-ray), and Space Plasma

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Physics. In addition specialist teams skilled in Electronic and Mechanical Engineering for space applications have been established at the MSSL. These teams play a vital role in the design and development of space instrumentation to the highest engineering standards. They also underpin an increasing involvement in several applied space science and engineering topics including the study of spacecraft charging in orbit, the development of spacecraft attitude sensors and the application of space radar data to resource mapping.

Except for Earth Remote Sensing, all of this work is mainly supported by the UK Science and Engineering Research Council and is undertaken with a wide range of international collaborators. Facilities for the work—the spacecraft and their launchers—are provided by the European Space Agency (ESA) of which the UK is a member. Access to space is also achieved through bilateral or multilateral arrangements with other nations. Collaboration with the US National Aeronautics and Space Administration (NASA) has been underway from the beginning and has been extraordinarily cost-effective. More recently UCL groups have gained opportunities in the space programmes of Japan and the USSR. Thus after more than three decades of involvement in space science and engineering, UCL researchers have established a considerable base of experience in the field and have collaborated widely with a variety of international agencies and partners throughout the world.

(i) Advantages and Disadvantages of Joining ISPs

In the space area the high cost of spacecraft and of their launch vehicles in particular means that international collaboration is virtually mandatory if UK research groups are to play a leading role in the many important areas of science that require access to space. While the UK has in the past constructed its own satellites and while it is possible in principle to purchase launch services, both of these courses are at present beyond the means of the Research Councils. However reductions in launcher costs might permit these activities in future for small payloads.

Since the first UK space mission—the joint US/UK Ariel I launched in 1962—a dual pattern of collaborative activities has evolved. Payment of a GNP related subscription to ESA entitles UK participation in the ESA “mandatory” science programme. Although the programme is broadly based, the rate at which opportunities arise is inadequate to sustain the health of UK space science. In addition the important field of Earth Remote Sensing is not included in the mandatory science programme. Therefore the UK, in common with other ESA members, also collaborates on a bilateral basis with nations such as the USA, Japan and the USSR. While these interactions are extremely cost effective and permit the gaps in the ESA related programme to be filled, they arise on an essentially opportunistic basis. Thus both modes of working are essential if a balanced programme is to be maintained across the entire range of UK interests. This is especially true for studies of Climate and Global Change from space which have recently attained considerable importance.

It is vital that the UK have a strong domestic programme if we are to take advantage of the opportunities offered by participation in ESA on the one hand and by bilateral collaborations on the other. The ratio of our national to our ESA related spend is the smallest in Europe and needs to be increased if we are to benefit appropriately from our subscription to the ESA mandatory science programme.

(ii) Advantages and Disadvantages of Hosting Large Facilities

The establishment of large facilities related to ISPs in the UK would bring considerable benefits. Related, usually high technology, industries could be established. UK universities and schools would gain from the possibility of more detailed exposure to the activities and achievements of the facility and its international staff. Finally the public awareness of Space Science would be considerably heightened. Given that no exceptional recurrent expenditures are required of the host nation beyond its normal subscription to the ISP, it is difficult to think of any corresponding disadvantage.

However it is most regrettable that a situation has arisen from the start in which no major ESA (previously European Space Research Organization or ESRO) facilities were established in the UK. Such facilities exist in France, Germany, Holland and Italy but in the UK only a small contract research activity in Space Tribology is operated for ESA by the UKAEA. In addition to the reasons given above, this is also unfortunate because the existence of major facilities confers the advantage of a closer association between the Agency and the host country. This can permit the latter to exercise a greater influence on the activities of the former. While it is unlikely that the ESA mandatory science programme will require the establishment of any new facilities in the near future in the UK or elsewhere, facilities such as the UK Earth Observation Data Centre at Farnborough will play a role in the optional Earth Resources programme through the analysis of data from the ERS-1 and -2 satellites. In the future as this programme expands, it may be possible to bid for the establishment of related facilities in the UK. The growing interest of the EEC in the use of space-based techniques for environmental monitoring and control may also lead to the establishment of European facilities. Given our previous failures to secure any ESA facilities, it is of the utmost importance that the UK be prepared to take the necessary political action at the highest level to secure any opportunities that may arise in this area in future.

*22 November 1990]**[Continued]**(iii) The Setting up of International Programmes*

Prior to the establishment of the British National Space Centre (BNSC) the various UK Government Departments involved in space interacted separately with ESA and other space agencies and national programmes. The co-ordination of all of these activities is now in the hands of the BNSC and the situation has been considerably improved particularly for interactions with ESA. It is therefore important that the involved UK Departments (DES including the Research Councils, DOE, DTI and MOD) should continue to co-ordinate their space work and strengthen the role of BNSC in implementing the overall UK space programme.

The influence of the UK both in ESA and in the space agencies of other nations depends primarily on the health of the national programme. ESA offers the facilities (launchers and satellites) for access to space but the selection of particular scientific investigations is highly competitive and the underlying technical and scientific developments that are required for success must be supported at the national level. This is also true for bilateral programmes where UK participation can only be achieved on the basis of the potential benefit to the collaborating partner and of the technical excellence of the proposed UK role. Our reputation as a reliable and successful partner in past collaborations is also a most important factor. The present situation does not favour our continued success in these areas. At a value of 0.07, the ratio of our spend on national and bilateral space science projects to that on ESA is the lowest in Europe. The figure for France is 1.09 but the figures for Italy and Holland at 0.52 and 0.28 respectively have very worrying implications for our future competitiveness in the field. Those nations with a higher spend on their domestic programmes will increasingly come to dominate ESA and our subscription will become a subsidy for access by others rather than a means of enabling our own research programmes.

(iv) Technical and Financial Criteria for the Consideration of Proposals for ISPs

Here the peer review mechanisms by which the scientific, financial and technical aspects of particular scientific investigations to be carried out within the ESA programme are evaluated are in general quite effective. This also applies to the evaluation of UK participation in bilateral co-operations with other nations such as the USA. However a problem arises in the lack of a clear separation between the funding of particular investigations within ESA and the payment of the UK subscription to the ESA mandatory science programme. The latter must at present be found from within the SERC budget for space science. Thus increases in the mandatory subscription either due to new agreements between member states, to variations in exchange rates or even in GNP figures can seriously threaten the support of the national space science programme which in turn supports the actual participation of UK research groups in ESA missions. In other European nations funds for the ESA subscription are considered separately from the requirements of the scientific programmes themselves.

(v) The Forums in which the Decision to Participate in ISPs is Normally Reached

In the area of Space Science UK participation in ESA and in its purely scientific predecessor ESRO was agreed upon in 1964 and has continued up to the present. Since the ESA science programme amounts to about 10 per cent of the Agency's total budget, the interests of the UK and the nature of our national participation are much broader than those of the scientific programme alone. Thus considerations related to UK participation have major political implications and would involve several Government Departments.

A recent report* on the management and efficiency of the ESA Science Programme although largely supporting the operation of the programme itself, commented in unfavourable terms on several aspects of the activities of the Agency in general which have a negative effect on the conduct of Space Science in Europe. In the UK the existence of the BNSC has meant that the conclusions of this review of the Science Programme can be rapidly assessed and used to benefit the larger UK role in ESA. Although a purely scientific programme could probably be run more efficiently, UK interests overall are better served by participation in a single European Space Agency. In this context however it is important that the political dimension of scientific participation in ESA be recognised particularly in respect of the provision of the national subscription to the mandatory science programme.

Decisions relating to participation in bilateral and multilateral scientific programmes are handled by the normal review mechanisms of the Research Councils and, given satisfactory support for the national space science programme, can usually be reached in a satisfactory manner.

* Report of the 1989 Science Programme Review Team (the Pinkau Report) to the Council of the European Space Agency.

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The principal comment to be made under this heading has already emerged in several of the preceding replies. The major disadvantage of the present approach to UK participation in the ESA mandatory science programme lies in the need to find both the national subscription to ESA and the support for actual participation in the scientific programme from the same budget heading. Thus the national programme budget should be protected from changes in the UK subscription arising from political factors, exchange rate of GNP changes. This is the case for other ESA member states.

(vii) Treasury Rules of Additionality and Attribution

Neither the ESA science programme nor the work conducted on a bilateral or multilateral basis with individual nations is affected by these rules. In the former case the payment of the national subscription to the mandatory science programme leads to the provision of spacecraft and launchers on which the UK groups can compete for space based only on the quality of their proposals. ESA does not fund the provision of scientific instruments or the exploitation of the data that they acquire. Bilateral or multilateral scientific programmes are invariably undertaken on a "no exchange of funds" basis. Thus there is no inflow of foreign money to the basic Space Science programme.

(viii) Impediments Within the UK to Engaging in ISPs

It again follows from the replies given above that exposure to the effects of currency fluctuations on the level of the annual UK subscription to the ESA mandatory science programme can directly reduce the support available for the provision of scientific instrumentation and the participation of UK research groups in the programme itself. Thus the paradoxical situation can arise in which the UK, having paid its share towards ESA facilities, is unable to make use of them and is in effect subsidising their use by those states who treat their research support separately from their membership subscriptions.

The generally lower level of UK salaries on the one hand makes it difficult for us to attract staff from many of the other ESA member states and on the other makes us vulnerable to the loss of many of our best staff to our continental collaborators and rivals.

Following the recent increase in the number of collaborative programmes with the USSR, COCOM restrictions are causing some difficulty and a relaxation of these rules for instruments which are to be provided by UK groups and launched on USSR spacecraft would be very helpful while in no way violating the original arguments for these restrictions.

For the other examples given (commercial secrecy, intellectual property rights), UK groups have been more than able to hold their own and have competed very successfully on the basis of the excellence and originality of their work.

(ix) Impediments in Other Countries to Their Engaging in ISPs

The concerns raised in the outline of issues under this heading are generally not of great significance. In any case it is up to the UK groups to achieve the most effective collaborations that they can. The outstanding successes achieved since the beginning of the space age, particularly in the area of bilateral programmes, suggest that the UK groups are indeed negotiating effective arrangements for collaboration. The different national budgetary procedure can cause delays in approving and starting research programmes.

ATMOSPHERIC PHYSICS

(i) Advantages and Disadvantages in Joining ISPs.

There are overwhelming reasons for joining ISPs if groups, laboratories or institutions are to participate in the planning and execution of front-line research. Such work should thus be rewarding and cost-effective to the UK.

On a pragmatic level, there are very many examples where a very modest financial contribution from the UK, relating to a key science or technology contribution by participating UK group, has greatly augmented an ISP, hosted and mainly funded by other nations; in such cases, the UK contribution may be small but nevertheless buys a very substantial scientific participation, and allows the respective UK community to participate in a major new facility. Particular recent examples occur in the NASA Dynamics Explorer Program, the CRRES satellite, the UARS and Eos Programs.

Except for very small scale efforts, perhaps involving only data analysis of earlier projects, even the collaborative efforts within national and international programmes need very considerable resources within

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individual institutes. Typically, the successful prior development and demonstration of a key scientific or technical aspect for a project is an essential component of a successful bid to join any International Scientific Programme.

However, the seed-corn resources to enable the prior demonstration of unique techniques require a sustained level of support which is vastly beyond the resources of even major Departments in the larger UK Universities. SERC Grants do not usually provide such seed-corn resources, and current grants cannot be diverted into the essential front-end investment. For major ISPs, it is virtually essential to call on resources of national laboratories and suitably experienced industry to support proposals to join or participate in ISPs.

(ii) Among the many advantages in housing in ISPs is the direct contact of academic and technical staff and students with the broad range of involved people and ongoing activities. This may also generate valuable local public awareness and certainly provides a broad and highly educational experience of all concerned with the wide range of essential day to day activities, and not just the state of the art technology and academic highlights. This is very good experience for students, technicians and managers working in and around the ISP, and not just the academic research workers who are directly involved.

(iii) The Setting up of International Programmes

In the Atmospheric Physics, most ISPs originate with national or international groups initially proposing to ESA, NASA, SERC, NERC. When a rough cost estimate indicates that purely national funds are unlikely to be available to complete the project, a sounding of individuals and institutes on the international scene may result in a proposal for a bilateral or multilateral project. Normally this would be headed by one major international agency, with participation from other national agencies. The type of involvement would depend on the type of project (space, ground-based, modelling) and on national or other agency guidelines. ISPs are normally subject to Peer Review by each agency, with perhaps a special international co-ordinating group to ensure "balance".

(iv) Technical and Financial Criteria for the Consideration of Proposals for ISPs

This is usually by peer review.

(v) The Forums in which the Decision to Participate in ISPs is Normally Reached

Projects, or proposals for new projects are often initiated by agencies (ESA/NASA) circulating a "Dear Colleague" letter, requesting outline proposals. These are judged by peer review and the process seems satisfactory.

(vi) Treasury Rules of Additionality and Attribution

Generally, participation in an ISP will be some combination of an "International Subscription" by the UK (and other countries) agreed on some formal (GNP) or *ad hoc* (vote) basis, and direct funding by the national agencies. There are problems over the carrying forward of committed, but unspent, funds over fiscal years. Minor project delays, or even billing/paying procedures, can create difficulties. Differences between countries and agencies can cause difficulties, such as different rules in the allowance for inflation or separation of main phase funding from follow-on costs.

(vii) Impediments within the UK to Engaging in ISPs

Perceived inequalities of salary or taxation relative to other nationals engaged in the ISP can cause major problems with recruitment/retention of ancillary staff, rather than perhaps academic staff. UK Students have often felt very harshly dealt with regarding travel expenses, etc., relative to other nationals. Inequalities of salaries and travel expenses, or "overseas allowances", between nationals employed by Universities and those with similar qualifications and experience employed by contractors have also caused considerable grievances. Rules such as the abatement of EEC contributions appear somewhat anachronistic. Restrictions on shipment of computer and other hi-tech, equipment have caused problems, and will continue to do so, despite the general easing of E-W tensions. Respecting intellectual property rights should not be a serious problem.

POSITRON PHYSICS

The Department is currently involved in two international collaborations funded by the European Community (EC) under the twinning initiative of its Stimulation-Action Programme. The specific projects are: (i) "Antimatter as Antihydrogen" with the Physics Institute, University of Aarhus, Denmark and (ii) "Collisions of positrons with atomic hydrogen" with the Department of Experimental Physics, St Patrick's College, Maynooth, Ireland.

The Stimulation-Action initiative is different in scope from the type of programme described in the other sections of this document since it functions through a grant-awarding body. Its aim is to stimulate co-operation across national boundaries within the EC and this is achieved by the award, after peer review,

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of substantial sums of money (typically £100,000) to small groups of scientists working on selected research projects. As far as collaborations are concerned the EC has thus become an important alternative source of funding to the SERC. On a cautionary note, it is not clear what the future role of the EC will be beyond the end of its current science plan in 1992.

(i) *Advantages and Disadvantages of Joining ISPs*

The EC Stimulation-Action Programme has brought great benefits to the positron group. Foremost, it has facilitated projects which were beyond the resources of the individual institutions. In doing so funds were brought into UCL for extra staff, equipment and travel plus a contribution to overhead costs.

A possible disadvantage is that collaborations of this kind involve senior staff in extensive working periods abroad. So far though this has been more than outweighed by the additional experience gained working in a different laboratory.

(viii) *Impediments within the UK to Engaging in ISPs*

Concerning the Stimulation-Action Programme, the EC demand that any staff employed on a contract must be recruited from a country other than that in which the work is being performed. This raises the general point of the difficulty of attracting good scientists from abroad into the UK due to the relatively low level of our salaries.

Examination of Witness

PROFESSOR SIR ROBERT WILSON, CBE, FRS, head of Department, The Department of Physics and Astronomy, University College London, called in and examined.

Chairman

575. Sir Robert, thank you very much first for the written paper from you and your colleagues which was of great value to us; and for coming here yourself this afternoon. I think perhaps we asked the previous witness about this question of the balance between national and international programmes and I think the conclusion we seemed to be coming to was that you should not regard them as separate. You yourself in your paper have brought this out and say you need to have an adequate national programme if you are going to get benefits out of the international programme or even participate. As I said to SPRU we get told, first of all, that you must engage in international programmes, perhaps you cannot afford to do it all yourself, and then you say we must have strong national programmes in order to be able to take part in international programmes which may mean in the end you are paying more than you would for a national programme. How do you strike the right balance?

A. I think first of all you have to look at the whole. It is no good saying that this is an international programme and that is a national programme. You have a programme which is a science programme and to pursue that programme you have to do certain things. For the big sciences we have gone into ISP out of necessity because you simply cannot stay at the forefront of the subject unless you do that. It is a necessity although there are other advantages in going into the international programme, such as interacting with people of different backgrounds and different approaches. The real reason, in the case of the major science, for CERN, ESA and others is certainly necessity. When you go in you should really go in and think of the whole UK programme. You have to say what is the contribution that we make to, shall we say, the big establishment; let us

take the European institutionalised establishment, either CERN or ESA, you make that contribution, that makes you part of it, you then compete for the use of that facility very often under extreme competition and when you win the slot either on a big accelerator or on the satellite, you have to find the funds to provide the instrumentation, not only the funds but you have to provide the know-how which goes with using those funds. It seems to me there is an obvious minimum level of national funding and that is the level that it takes you to fund the instrument when you win the place. It would be quite silly to say: "We pay our contribution but I am sorry, thank you for that offer but we cannot afford to fill it". That is the minimum level. I say the minimum level because if you only do that then you really do not have control over your science programme. It depends on the peer review committee which happens to think your experiment in that particular area at that time is better than another one. So out of this will emerge a programme but not a programme which is planned nationally, it is what you manage to win. Now you need additional national funds over that minimum level in order that you can maintain a sensible programme, a programme whereby, for example, you can fund the seed corn. If you do not allow the people the development resources in that area but only enough to build instruments, then instruments in the future there will not be because they will not have the expertise. Also, sometimes you need a national programme, which could be purely a national or international arrangement with some other countries, because there is a big gaping hole in the programme because the selection process did not fill it. I have some numbers for ESA, I suspect the situation is similar for CERN, given to the 1988 conference in Capri, all the countries in ESA were asked: "Tell us what percentage of your spend in space science, not technology, do you spend

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PROFESSOR SIR ROBERT WILSON

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[Chairman *Contd*]

compared to the total funds you put into ESA, in other words the total funds of your contribution to ESA and the cost of the experiments you fund for ESA". The figures were quite remarkable. The lowest percentage in the whole of Europe was this country, 7%. That means in this country we are making sure we exploit the facility but we are near the brink, if we pushed too far, by exchange rates, we will start reaching the point of not being able to fund the selected instruments. The remarkable thing is that our 7 per cent compares with 67% for Germany and 109% for France. I am not sitting here suggesting the French and Germans know all about space and that we should copy them; all I am saying is a totally different judgment has been reached in other countries. It will take a long time to pursue all the reasons for this but there is a major difference.

576. Apart from the ESA programme, which some of us are fairly familiar with because we studied the space programme, is this happening in other fields?

A. I believe, (although I do not have similar numbers and it is difficult to get those numbers, they are there because ESA asked the different countries) that in particle physics it is a similar kind of situation where it is funded sufficiently to be able to instrument these facilities. It strains particle physics in the Universities who cannot afford sufficient research fellows because they do not have the funds. The academic scientist has to come back to teach, which is just as important, some people say more important, than doing the actual research. I have a feeling in particle physics that it is a similar situation where we are funding at the level which I have defined as minimum level.

Lord Dainton

577. Is Professor Wilson saying that really we are just not getting value out of the international facility for the capital costs for which we provide because we are not spending enough year by year?

A. No. I have to explain. It happens that in both of the organisations we are discussing, in space and particle physics, were set up when this country was undoubtedly the strongest in those two science fields and now we are riding on the inertia of that. What I am saying is if we continue in this way then in time, indeed, Lord Dainton, we will not get value for money because the scientists will no longer be able to maintain their expertise.

578. Those like France who are paying 109% of what it is you said or Germany at 80 something per cent, are they getting value for their money at those high levels of annual national expense or is there a point above which it starts to be unproductive?

A. First of all, I said I would not defend those judgements, but only that somebody has made those judgments.

579. It will be interesting to know your views.

A. I feel reluctant to try and judge the whole of the French and German particle physics and space science programmes against their levels of funding. They are good but, for sure, if you look *pro rata* they are in the case of space science, it cannot be said that the French programme is 15 times better than the UK.

580. Is there a kind of optimum percentage that we ought to be aiming at to get the maximum out of that money which we have already invested?

A. Yes, I am sure there is but it is a matter of judgment what that is. I would say, being rather simple minded, if you have national funds to exploit the facility you should try and take the same amount again in order to have the flexibility to prepare your science for the future and to fill those holes. That is my judgment.

581. Your view?

A. Yes.

Lord Lewis of Newnham

582. I think somewhere—I am sorry I cannot put my hand on it—in this report you wrote there is a remark: "We are in danger actually of subsidising countries in the use of these instrumentations because we have not got the extra money to utilise them to the degree we should". Would that be a fair statement?

A. The remark was made in the context of the reduction in the national part of the budget due to pressures of GNP and exchange rates and so on. It said if the policy adopted, which was that the research council had to bear this entirely, then in the end the ultimate result could be that. The number I have given you for the ESA would imply we are not far away, since we are only providing 7 per cent of our total expenditure in space for the national programme. We are not there yet but we could get there before too long.

Lord Nelson of Stafford

583. I would like to ask Sir Robert: in his report he refers to the advantages of hosting large facilities. We do not host very many facilities, in fact, but you point out the very good advantages that have come out of that. Do you think the decisions to host or not to host are wisely taken? Are they thoroughly examined before the decision is taken?

A. Not in this country. I do not mean to imply it is in other's but I suspect it is. The hosting of a large facility gives a country not only the science advantages which you can identify, there are other advantages. Economically, you can count out the salaries of the people who will be employed and spending the money if you have it. The stimulation for industry, you could get some idea from the technological industries dotted around CERN because of its stimulation. So I believe there is a wider factor than the pure science one.

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[Continued

[Lord Nelson of Stafford Contd]

The Science Research Council sit down and negotiate: they do not say "Oh, yes, but it is good for politics in the UK or the local economy"; they have a budget and they have to do things within that budget. Other countries do things which I think we should possibly consider and that means widening the dimension of the discussion and not just leaving it to the scientists.

584. Who should do that? I rather get the impression we do not do that along the lines you mention.

A. We do not do it. I can say what should be done and that is a simple calculation of what is the economic advantage, we make an estimate of technological stimulation and then we can give preferred terms in order to get the facility in this country. This is what other countries do—for example, give them an acre of land and charge a peppercorn rent.

585. Of the individual agency does not get those advantages, it merely foots the bill and says: "We cannot afford it"?

A. Science has to be the most important element but in addition to that I think a wider view looking at UK Limited might be a sensible thing at that stage.

586. Who do you think might do that?

A. I do not know. It has to be, obviously, wider than SERC which, is not a political or economic organisation. Perhaps some wise person from the House of Lords can do it!

Chairman

587. Both on Lord Nelson's subject and the one we were discussing just before, you could put the other point of view. You could say that with France spending the amount it does on space, by making a minimum contribution to take part in the mandatory programme of ESA and a small bit of the optional programmes we are gaining from all the effort that France has put into space. I am just putting the Treasury devil's advocate into it. You could also, from the point of view of hosting, say, take much the same argument. If you host something, take JET for instance, you are inextricably left with it as long as it runs and then when it is finished you have got to clear the thing up, you cannot escape from it under any circumstances. Again, you could say that in a way if you do not host one of these should you take part in it because the person who is hosting it is, to an extent, subsidising the others. Do you think those are arguments which are not valid at all?

A. They are valid but it is a matter of judgment on the advantages which I have outlined again in that particular argument. My view is that hosting is undoubtedly the greater advantage because if France has put a lot of money into space and if that helps ESA we will have some help from that, but

simply to give up any kind of real control over the future space programme and leave it up to France and Germany is a very heavy penalty to pay for a return of some technological stimulation.

Lord Sherfield

588. You say somewhere that UK industries are extremely reluctant to tender for the equipment of commercial co-operative programmes and that was notorious in the case of CERN. Have you seen any proof in the case of ESA?

A. The two situations are, in fact, quite different. The remark was made in the particle physics section and it referred to CERN and not to ESA. In the case of CERN there is some great reluctance and you should ask the industry why, but the story we hear is that the particular demand of technology for CERN is on heavy engineering with tremendous accuracy which is more appropriate to industry which is heavily involved in defence and in this country MoD operates by cost plus contracts, whereas CERN adopted fixed cost contracts. We were told one was easier and more lucrative than the other, whether that is true or not I do not know but that is what is said. ESA is totally different. CERN does not have the *juste retour* principle but ESA does. In the case of ESA the UK industries have been able to win contracts and the problem for ESA is to hold UK industry down to its *juste retour* limit. I think the reason for that is that in space in Europe the lead country in the 1960s—and I mean lead by a long way not just in front of almost any other country—was the UK; we made rockets, for example, and also put the first satellite into orbit other than the United States and the Soviet Union.

589. These are the Ariel series?

A. The Ariel series. These were made by British industry. When ESA was formed, *juste retour* restricted returns to this country and we would have been much better with it the other way: *juste retour* for CERN, no *juste retour* for ESA! The circumstances are totally different.

Chairman

590. Have you got, Sir Robert, any suggestions to make about how we should get over these difficulties? First of all the difficulties connected with a combination of underestimating inflation and also the fluctuation of exchange rates, which is slightly different from the problem of attribution, and the two together are causing a great many people a great deal of concern. Have you any golden solution which would make it all right?

A. No, but perhaps some comment. The reason why the fluctuation problem, and let us take CERN which was a severe example against the Swiss Franc and the movement of GNP in the UK, was simply that the perturbation was too big for SERC to accommodate it. If you have a perturbation you have to be big enough. If the perturbation swamps you it is very difficult and SERC is not big enough.

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[Continued]

[Chairman *Contd*]

You need a bigger buffer. The other countries had it by using a major Department of State, such as the Foreign Office. I would be very unhappy to see that buffer become the Foreign Office or the Treasury, or anything like that.

Lord Dainton

591. It could become the unified research council?

A. If it is big enough. It might have to be the whole DES or the whole science budget but you have to reach a point where the buffer becomes big enough for the perturbation to be absorbed without causing tremendous damage. The money still has to be found from somewhere but that is alright as long as the fluctuations in time smooth out. The difficulty is for some time now it has been going one way and it would be wrong for the scientists to ask whether, while it is going one way only, it can still be accommodated by somebody else. If it is going one way there may be some long term plan to grasp that situation, but how that would happen I do not know.

592. What about the effect of attribution on the Research Council's budgets?

A. The non-indexation problem?

Chairman

593. No, the Treasury's principle of attribution. This applies only to the European framework.

A. Yes, sorry.

594. If the programme develops beyond what had been originally estimated and if an extra cost is attributed to the Research Council concerned?

A. First of all, let me say that has not hit my Department very much and this is a Departmental submission. We can only tell you what we know and have had experience of. As yet we have not got a lot of EC contracts, we are now trying to do so. I think it is just plain silly. If you go through the EC system, the bureaucracy and the paper work is staggering, it is quite frightening, it is bad enough in our own country. If you say: "Here is a route but a far more difficult route and if you win anything at the end of the day we will take it away from you" it is an obvious impediment to scientists in this country trying to go there. We should say to them: "That is marvellous, we have more EC funds in this country, that is our reward" and leave them where they fall.

595. On another subject: do you think there is a serious brain drain from this country into Europe because of the salary itself and not only to Europe to elsewhere which is not counter-balanced by people coming back?

A. Again, I do not have any statistics but I do not think it can be said to be serious. What I think is serious is the danger that it may become serious because we have a situation, for example, in the EC

contracts, like the stimulation scheme which we have won in the Department, where you get money also for staff but, the rule is you cannot employ anyone from your country. I agree with that, it is a political reason, but you have to pay the salaries of the country you are in, so on this we find it almost impossible to get a German or Dutchman to come over on a British salary. But, of course, when that contract takes place on the continent and a British person is offered a job, he says "Oh, my goodness" and he sees he has been offered a salary far higher than into this country. So there is a tendency to impede the progress of such scientists in this country but to encourage the employment into others. Ireland is an exception.

596. Ireland is an exception?

A. But the interaction is very small.

597. What about this problem of the complications of research, fellowships being complicated by, in our case, having a teaching responsibility as well?

A. I personally am strongly in favour of everyone doing research also doing some teaching. If you really want to learn your subject get in front of fifty young clever people and lecture to them and then try to cope with the questions. It really makes you think. So it is not just a contribution to the institute of learning these people make, it is a contribution to their own training. I think you could spend 10 or 20 per cent of your time teaching and not in any way say: "Well my research has suffered". So I am personally strongly in favour of it.

598. You would not be in favour of trying to see that more researchers who are involved in international programmes should be relieved of teaching responsibilities?

A. No. Certainly you should not reach the point when you have more teaching than research, you have to get the balance right, I would have thought 10 or 20 per cent of time in teaching is very sensible, in fact the optimum I would say.

599. The two major complaints we have had out of the evidence were, first of all, in the top-down big projects it takes an awful long time to get a decision as to whether we are going to participate or not—this is particularly in projects which cost so much that they are above the level of decision of a single research council—the other is the bottom-up one that there again where people have found the nucleus for an international collaborative programme and you put the thing to the research councils, it then takes a very long time again to get an answer and meanwhile it is very difficult to hold the prospective collaborators together. Do you think these are valid criticisms? If so, where do you think the fault lies? Is it in the research councils or outside or where is it?

A. Certainly it is a very valid criticism. A decision taking time now for some major projects has spread to several years and, of course, if you see the young

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[Continued

[Chairman *Contd*]

scientist who is going to be the one who is going to do it all ten years from now, who enters the project and finds it is five years to a decision and another five years to completion, ten years is too long. So, we will lose those scientists. There is no doubt the criticism is valid. As to how or why it is, I do not know. If I take the example of the European Space Agency, there they start off by inviting proposals, often with a defined objective, and these are assessed and that takes up a whole year and after that they start having design studies for this process, another year, and after that they select a few for phase A studies. The last such process in ESA was one in which four were taken through phase A studies, four, in order to pick one. There is a strong tendency for some major organisations to like to have lots of paper work, lots of proposals, lots of competition and so on. My experience is it is always worse in an international body than a national body in this particular context. All I can say is I see it happening but I cannot explain why it happens but it is important to try and stop it and to shorten this decision taking process.

600. That would appear to be an argument against international collaboration. Is the answer to that not then to try to stick to national programmes as much as you can or to engage, as happens in your own field, in direct bilateral or trilateral arrangements?

A. No, I would not accept that. I think the argument "it is more difficult therefore we should not do it" is not a good one. We have to solve the additional management problem that you have in an international organisation compared to a national one. That is the only way to go about it, to solve the problem but not to avoid it which is what you do if you say: "Let us go national". The United States does not have the problem of saying: "We have to get all the councils in the States in the US together". If we all went national there is no doubt at all we would go third class in Europe very rapidly.

601. Instead of ESA you could have a French national programme with which the British and Germans collaborated, could you not? Would that not produce a better answer?

A. It might, yes it might. There are different ways of having international collaborations. You do not have to institutionalise them. There are several in the Department, for example three countries get together, they agree their objectives, agree what to do, how much to pay and do it. I have to say—I had better clarify it after I have said it—my experience is these multi-national projects are better, smoother and that the camaraderie is there much more than in the institutions. I believe that is true, but not because one method is better than the other. I suspect we have not yet developed a European international institute in the best possible way.

Lord Nelson of Stafford

602. In your section on ground based astronomy you refer to the fact the application of the AAO method of administration by Hawaii and La Palma would be a better way of operating. Why do they not change the method of operation if there are such advantages to be had as you indicate.

A. Yes.

603. Who should make the decision to change?

A. I smile because it is a slightly delicate area. Let me explain first the different ways of operating. In the case of the AAO, the AAO has total management authority for the observatory. It has two paymasters. It has to convince them they have to give the money but when they have the money they have total authority. They have two telescopes up on the mountain and they have the base camp in Sydney staffed by fifty people.

Let me now take JCMT. I happen to be Chairman of the Board of the James Clerk Maxwell Telescope which is a 15 metre diameter radio telescope operating in the sub-millimetre range which is the highest radio frequency you can get to. There are four countries involved, the UK (who designed and built it, at RAL, and this telescope has been awarded the MacRobert Award, the highest engineering award you can get in this country), the Netherlands, Canada and the United States because it is on US territory. The management Board was formed with representatives from all of those countries, which was a jolly good idea, and I happened to be elected Chairman of that Board, but a dispute arose, and is still continuing, between the Board and SERC about the nature of that Board. The SERC top management claim the Board is advisory, and, therefore, it is SERC who manages it so they will manage it and let us know how they are doing and so on. All the members of the Board, the UK, Dutch, Canadians and Americans, disagree with this totally and the other partners say their agency believes it is a management Board. They say: "We give you the money, go and manage it", so we have this dispute. If JCMT moved towards the AAO model we can do so simply by the agencies agreeing that that board has management authority which means full control of the budget and resources. Thus the management Board might say, and they have already said this: "We do not like the idea of having a team of JCMT located on Blackford Hill, we think they should be in Hawaii." SERC say: "We want our people up there in Edinburgh to do this job". That is why the conflict is delicate, it is linked to actual SERC establishments in this country.

604. Not to touch on the Americans or Canadians?

A. Not them.

605. AAO has gone on?

A. There has been a change of chairmanship within SERC and my letter to the new chairman may result in a resolution of this but there has been a

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[Continued]

[Lord Nelson of Stafford *Contd*]

major difference of view. The other thing is the cost effectiveness of AAO which operates with 50 staff in one place. The two other observatories also have a facility on the mountain, they also have a laboratory at the base of the mountain which each have about 50 staff. But in addition to that each has another establishment, one of the Royal Observatories, in this country and many astronomers have said at some time, and I am one of them, it is quite unnecessary to have two establishments in this country to support observatories when the observatories are elsewhere. The Royal Observatories are not observatories, they are establishments, they do not observe anything, the name is entirely historical and we should recognise that. There is a great belief we could make the whole process more cost effective by reducing the number of establishments in this country to one. The AAO gives a perfect example because it works. Everyone says the Anglo-Australian telescope is the best instrumented optical telescope in the world and it does not have a big establishment sitting in the country.

Chairman

606. Would you like to comment on the differences in collaboration between Europe, the United States, Japan and the Soviet Union?

A. Yes. From personal experience I cannot actually comment on all those relationships although, in fact, all those relationships exist within the Department and they do vary considerably. The first thing I think I should say from experience is that when you have an international collaboration it is essential for every party to recognise that the others have different systems, different regulations, different timescales for decisions, and unless you adjust to this you will not get very far. The collaboration with the Soviet Union is possibly most difficult, not because of the people involved but because of the system although that is improving all the time, but in the past if you collaborated with the Soviet Union you probably would not know anything that happened on the other side and that was a great disability. Between Europe and the United States it is difficult to compare because there is no doubt that we in this country seem to be able to collaborate

with, and mingle with, the Americans better than many of our Continental Europeans, that may be the common language, but I really do not know. We have in the Department, particularly with the United States, several collaborations which are unbelievably successful, more successful than those we have had through the European Space Agency. The IUE was an American UK venture in which we invited the European Space Agency to enter and it has been one of the most successful satellites ever. President Reagan gave it a very special award at the end of his last term of office and there were only 10 given. The relationships with the Americans are very good. With the Canadians I mentioned JCMT, they are very good. With the Dutch, the British seem to get along exceptionally well, certainly in astronomy, perhaps because we both have terrible climates for the subject? This was not so easy with the other continentals, although language may be a large part of this rather than national characteristics and so on.

607. You would not support what a lot of people say, that in attempting to collaborate with the United States they tend totally to drive the programme and you do not get enough influence in it?

A. My own personal experience, which is very extensive with IUE, is to the contrary. IUE was a British proposal and it may have been because of that, of course, being a British proposal, that the Americans decided to adopt it and they picked up most of the cost. But we made a very strong intellectual contribution and it may be because of that we got an unbelievable deal from the Americans. Our contribution in monetary terms, not intellectual terms, was about 7 per cent. We got 15 per cent of the observing time and we had a seat on the management committee to participate in the main decisions.

608. That was because we had a strong base in this country?

A. Yes.

Chairman] Unless my colleagues have any other questions thank you very much indeed, that was very helpful, we are very grateful.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE
SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Thursday 29 November 1990

ADVISORY BOARD FOR THE RESEARCH COUNCILS

Professor Sir David Phillips

MEDICAL RESEARCH COUNCIL

Dr D A Rees and Dr D Evered

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THURSDAY 29 NOVEMBER 1990

Present:

Adrian, L.	Nelson of Stafford, L.
Carver, L. (Chairman)	Nicol, B.
Dainton, L.	Porter of Luddenham, L.
Flowers, L.	Shackleton, L.
Kirkwood, L.	Sherfield, L.
Lewis of Newnham, L.	Taylor of Blackburn, L.

Examination of Witness

PROFESSOR SIR DAVID PHILLIPS, FRS, Chairman, Advisory Board for the Research Councils, called in and examined.

Chairman

609. Thank you very much indeed for coming and talking to us this afternoon. It is very good of you to give up your time. If you do not know, as you probably do, who we all are, you can see in any case we have our names in front of us. I am sure you know our two specialist advisers, Professor Roger Williams and Dr Mick Lomer. When we started off on this study we did so very largely because we were told that the current machinery in this country for responding to proposals for international scientific programmes was thought to be inadequate for the job, either in its coherence or in the timing of response. It was pointed out to us that the mutually beneficial response (beneficial both to us and the other participants) required both initial co-ordinated actions by non-governmental bodies, quangoes and departments and other agencies of government, and continuing involvement of them in a number of complementary ways. Would you like to say whether you think that that was a valid criticism, and if not why not, and if so what ought to be done about it?

(*Professor Sir David Phillips*) Thank you, my Lord Chairman. I think I would have to begin by saying that, in my opinion, it is necessary to distinguish a little more precisely what one means by international scientific programmes. If you will bear with me, I would say that there are at least five distinct categories of programmes, and the strictures that you have put forward apply to perhaps some of them, and I will come back to that. At the lowest level a great deal of international scientific activity goes on at the initiative of individual scientists who want to collaborate across international boundaries, and they are often supported by the research councils and other agencies, such as the Royal Society, but it does not involve any great bureaucratic apparatus. Broadly speaking, they simply get on with it. Secondly, there are quite large scale collaborations in international programmes, which often take place under the wing of international bodies like ICSU, which involve, say, a research council agreeing that it will carry out a programme that it is in its own interest to do, that it will itself manage, but the advantage of involving it in an international programme is that it will take place alongside complementary programmes conducted by people from other countries. Again, provided the research council knows it has the

resources to engage in such a programme (such as, for example, the International Geosphere Biosphere Programme under the auspices of ICSU) it does not require a great apparatus to get such a programme going; although there will usually have been a lot of international discussions, as I said, under the auspices of ICSU or some other body. Thirdly, there are often bilateral agreements between research councils and their opposite numbers in other countries, which set up joint programmes—for example, I think I remember that the Medical Research Council had a joint programme in China on an epidemiologic aspect of one form of cancer, where the advantage was that this form of cancer was very prominent in a particular part of China. Again, if the council had the resources to do it, and made contacts with the other country, then there was no particular super-structure of bureaucracy that inhibited that. There has been a recent example: the Science and Engineering Research Council in the summer came very close to an agreement with Germany to engage in a gravitational wave experiment. That, again, is a bilateral discussion. Whether it can be done depends on the resources available to the Science and Engineering Research Council. Agreeing what should be done was not a problem. Fourthly, and now we get into a much more difficult area, there are of course multilateral enterprises, such as the European Space Agency and CERN, which do depend upon international agreements where the participating agencies in the first place do not have the resources simply to go on and make an agreement, and which in any case do depend upon a certain amount of political judgment and the allocation of resources; and here I think one does begin to get into the region of where there can be bureaucratic and political delays. Finally, there is the particular example of programmes within the European Community, which I suspect you are particularly interested in, and here I do think that there can be difficulties in negotiation—for example, on the details of the Framework Programme. One would like to see the United Kingdom playing a main part in determining the features of the programme, so that they accord with United Kingdom priorities; otherwise, any resources that we get from such a programme will in the end tend to distort United Kingdom priorities. So one does want to see a large input. I am not sure that in the past, for various reasons which you will have ideas about and

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[Continued

[Chairman Contd]

may well want to ask me about, that scientists in the United Kingdom have played as big a part as they should in determining those programmes. I think settling the details of those programmes, which involves Ministers at a high level and complex negotiations, has often taken a long time. Also, for various reasons, at the other end of the process scientists, I think, have from time to time been inhibited about becoming involved with such programmes. I think your strictures apply to a degree to my categories 4 and 5, and perhaps you would like to explore that further.

610. What part did the old ABRC play in this? What part does the new ABRC play? Do you think it should play a larger part? Perhaps if you could expand on the relationships between ABRC, in the past and in the future, and with the Science and Technology Secretariat under the Chief Scientist in this field?

A. The old ABRC was, of course, a rather large advisory body, and it was charged with looking at the balance between national and international activities, so it did take an interest in that; but its influence over the research councils was limited to some extent by the fact that the heads of research councils did not play a full part in all the discussions at the ABRC. Under the new arrangements (which began in April of this year with new terms of reference) there is responsibility for advising on two relevant issues: on the international and national balance; and on the co-operation between research councils in all the things that they do, which is much emphasised. It is a small body. The heads of research councils play a full part in all of its affairs, and here I am treading on slightly dangerous ground, and it is in a sense quasi-executive in that the Secretary of State tends to accept its advice on the allocation of money. If the heads of research councils, after taking part in all the debate, are aware that the ABRC as a body is not in favour of some international activity then that particular research council will think very hard before taking steps in that direction. If, on the other hand, it knows that the ABRC is in favour of an international activity and is advising the Secretary of State in that sense, it will do what it can to promote such an international activity. There is also your particular point about the interaction with the Cabinet Office. The Chief Scientific Adviser in the Cabinet Office, now Professor Stewart, is an assessor on the new ABRC and plays a full part in the debate. He involves me and the heads of research councils and other members of these organisations in discussions about European and other programmes; but that is essentially in a consultative, advisory mode. I would not claim that the ABRC has any executive function there.

611. Will you get directly involved in the consideration of the European Framework programme?

A. Yes.

612. The ABRC would be directly involved?

A. The ABRC only yesterday discussed international affairs generally, and it comes back to that on a regular basis. The ABRC I do not think I can say has been asked specifically for collective advice by the Cabinet Office, but I and other members of the ABRC have often been asked for particular advice.

613. Do you think the ABRC should be asked for collective advice on the European Framework programme when it has been worked out?

A. I would be quite content for that to happen, yes.

Lord Flowers

614. Is the ABRC represented in the discussions that go on in Brussels and elsewhere in Europe about specific projects where quasi negotiations are taking place between civil servants of different countries?

A. The ABRC is not represented in the sense that it sends a nominee to take part in these discussions; but I have myself, for example, long been involved in the committee on the development of European science and technology (CODEST) and have often been involved in discussions of different aspects on that side of the programme.

Lord Shackleton

615. Are there a number of individual contacts that go on giving advice as you do on this?

A. Yes.

616. Really, quite apart from the ABRC?

A. There is another member of the present ABRC, Sir Charles Reece, who is also a member of the CODEST Committee; and a member of the old ABRC, Sir Peter Swinnerton-Dyer, is not only a member of the CODEST Committee but is Chairman of it and, as such, has very considerable diverse contacts in Brussels.

Lord Taylor of Blackburn

617. Even though you have no direct representation on the Committee you are fairly well briefed as to what is going on and what progress has been made. You are able to put your input in, off the record or by whatever means you have got of consultation?

A. Yes.

Chairman

618. Criticism has been made to us by various people, including the MRC, that particularly in respect of the European Framework programme the decisions about it seem to be made more on the basis of financial reasons than from the point of view of the scientific advantages of the particular programme. Do you think that at present the machinery, with the ABRC as it is and the Cabinet Office Secretariat as it is, is all right, or do you think

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[Continued

[Chairman *Contd*]

there should be different machinery to make certain that there is a better or a more, as it were, influential scientific input when the programme is being decided?

A. I think, my Lord Chairman, it sounds to me as though the MRC were questioning the prioritisation of the Framework programme; that is to say, how resources are allocated to the different parts of it. I have certainly played no part in discussions of whether the environmental science aspect should be given more or less priority than the human mobility aspect, for example. I do not know that many scientists have been involved in that discussion. That, I think, probably originated in Commission proposals which were then discussed at CREST or at the Council of Ministers into which the research councils and other bodies have only a limited input.

619. You are not dissatisfied with the existing machinery?

A. I would not want to give the impression that I was desperately dissatisfied; but I would not either like to give the impression that I was absolutely content. I do feel that formal scientific contributions to the debate about European programmes and, in particular, to priorities between programmes in Europe are not as strong as they should be.

Lord Nelson of Stafford

620. In that respect what views do you have about the Treasury practice of attribution and the way that reacts back on the programmes of the research councils?

A. The whole question of attribution and additionality is extremely complicated. I sometimes wonder whether outside the particular section of the Treasury concerned there are 100 people in the country who actually understand what happens in practice. I am not sure that I would count myself among that number! Nevertheless, there are undoubtedly beliefs about it which affect the attitude of scientists to getting involved in European programmes. There is, I know, a belief in many quarters that if you gain money from being involved in a European programme, somehow or other the research council or you will lose the money that you have gained—by it being lost from the research council budget. That I think is an exaggeration, to say the least.

621. That influences their attitude?

A. I do think, and presumably the responsibility lies with the Treasury but I am sure your Lordships could influence this, that someone should put out a popular guide as to how the system works so that we know what is going on.

Lord Flowers] They do not want you to know!

Chairman

622. Do you have anxieties that the European Framework, either because of this or generally because it is giving emphasis to comparatively short-term research, is distorting the priorities of British science? Are you in favour of it on the whole?

A. On the whole I am in favour of it. The part that I know best was the old SCIENCE programme under Framework II, and in my opinion that had a very useful effect in improving working relationships across Community boundaries. Incidentally, the UK got a quite significant return from that programme—quite largely I believe because for various reasons, including the existence of a well established exchange programme with European countries run by the Royal Society, UK scientists were rather well geared to the idea of arranging collaborations with European colleagues.

So I am in favour of the programme. I think some aspects of it have worked very well and I do not think I know of any evidence it has yet distorted UK priorities.

Lord Flowers

623. Could I ask about categories 1, 2 and 3 which Sir David mentioned—at the moment we are talking about mostly the big stuff, 4 and 5—but 1, 2 and 3 are where international organisation does not really come into it. I wondered whether you felt the research councils were sufficiently sympathetic towards the encouragement and support of international collaboration in those categories?

A. Yes, I think so.

624. Bearing in mind that your particular project, on which you want to collaborate with someone from another country, is only part of the problem, the other part someone else will pay for, so your half project is being compared with somebody else's which is wholly in this country and can be seen in total, and there is a natural barrier the research council has to face when it decides whether to fund it.

A. Nevertheless, the Science and Engineering Research Council spends approximately £9 million a year on the sort of international activity I was describing in category 1: people who want to collaborate across frontiers. The Natural Environment Research Council, through the World Ocean Circulation Experiment and the International Geosphere Biosphere Programme and so on, depends very heavily on bilateral and multilateral arrangements under ICSU and other international bodies of that general kind. When we come to larger scale collaborations, such as the putative one I mentioned, collaboration with the Germans in a gravitational wave observatory, there the ABRC does have influence of a rather direct kind. Whether councils can pursue that sort of activity depends very much, as indeed it does in category 2, on whether they have the resources to do it and whether the ABRC recommends to the Secretary of State that they should have those resources.

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[Continued]

Chairman

625. The criticism has been made in quite a number of different circles to us that when the nucleus of an international project is being got together as a bottom-up project of that sort, which is within the financial capability of the research council itself, it tends to disappear in a sort of cloud for a long time before approval comes out, during which time those who were concerned with it and wanted to get on with it, do not know what is going on and the thing is liable to fall apart. Do you think that is a valid criticism? This is obviously the machinery within the research council itself. Do you think that is a valid criticism?

A. That happens from time to time—and indeed the gravitational wave experiment, I am afraid, will be an example of it—when research councils begin to plan such a bilateral or multilateral enterprise without having the resources assured to support it. As you will have noticed in the papers, the Science and Engineering Research Council has actually, under present circumstances, had to defer continuation of this gravitational wave experiment in collaboration with Germany, and the people involved no doubt wonder how long that deferral will last. No one at this point could tell them.

Lord Lewis of Newnham

626. How far do you believe commitment to international programmes provides problems for research councils when they are under financial difficulties particularly SERC, which seems to be in significant financial problems?

A. There can be no doubt, as I am sure we all understand, that there are several categories of inflexibility in research council programmes. The least flexible of all of these are programmes governed by international treaties, such as our involvement in CERN or the European Space Agency; and the most flexible of all are research grants granted to scientists working at the bench in institutions of higher education. In between there are various degrees of inflexibility, tending towards inflexibility the more one gets involved in international activity.

Lord Porter of Luddenham

627. The sort of problems you mention on the gravitational wave programme cannot do us any good in Europe. It must enhance our reputation of being slow to move, and rather grudgingly when we do. Do you have any idea of how this could be improved? Is some sort of co-ordinating office necessary, perhaps a small one, just perhaps one person would do in the Cabinet Office, who can look at this problem, so the British can get their act together? Also, you mentioned bringing the scientists in at an early stage and getting their act together before we make fools of ourselves in Europe.

A. The question you have asked, Lord Porter, is a peculiarly difficult and sensitive one for me to answer. The fact is the Advisory Board for the

Research Councils over the last two years has not supported the Science and Engineering Research Council's bid to get involved in a gravitational wave observatory, either by itself in this country, or in collaboration with German colleagues. It has consequently not recommended the Secretary of State to allocate resources for that purpose. The Science and Engineering Research Council, nevertheless, believing this to be a very important project, sought to squeeze the necessary resources out of its current funding. Under the pressure of this year's settlement, they have found that impossible to pursue. It is worth adding to that, that it is not enough for the world to have a single gravitational wave observatory, there need to be, as I understand it, at least two. In the American budget this year, the National Science Foundation has not been awarded the funds it needed for its gravitational wave observatory. I am not sure at this stage therefore that one could say that we have acted particularly irresponsibly.

Lord Nelson of Stafford

628. Could we be clear what the role of ABRC is in initiating international projects or in monitoring international projects of the research councils which they have resourced?

A. There is one role which is perfectly clear, Lord Nelson. If the resources needed for collaboration by the research council in a large international project are outside the scope of that council's current budget, then it has to make forward plans to show the priority that it attaches to this project, the reason why additional resources would be needed to engage in it, and the Council has to persuade the ABRC that it should recommend to the Secretary of State that those additional resources should be provided. So the ABRC has a very direct role in the management of large scale projects.

629. Where additional resources are required?

A. Where additional resources are required, yes.

630. But not otherwise?

A. Otherwise in the sense that the ABRC also looks at the balance of the council's baseline activities and questions whether the council is using its money to best advantage in accordance with its own declared priorities.

Lord Lewis of Newnham

631. How much money are you actually talking about for one of these stations?

A. It is a spread of expenditure over a number of years, and I think when we were talking of one observatory in this country a figure which was much discussed was £7.5 million. That does not sound a great deal compared with the overall budget of £900 million or so. The spread of expenditure proposed for the German collaboration was rather less than that over a period of five years or so.

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[Continued

Lord Adrian

632. You spoke, Sir David, of formal scientific input in these matters and I take it the ABRC now, since its reorganisation, primarily gets its advice from the heads of research councils. I wonder how far it can be said to be formally scientific, if you see what I mean, when the research councils' heads are so financially interested in the consequences of any decision there may be in terms of whether to join an international programme or not, since their budget is liable to be top-sliced if they do join?

A. I am afraid that I have not quite understood that question. Perhaps I can approach the answer to whatever the question was in this way: the new ABRC seeks to adopt a rather corporate attitude to the management (if you will excuse the word) of British science. Each individual head of research council, in addition to having a role in defending and promoting his own executive responsibilities, also has a rather more general responsibility in looking at the overall balance supported by all the research councils. That is something which heads of research councils have to learn and which I would say they are learning very quickly.

Lord Adrian] That is the answer to my question.

Chairman

633. Could you say something about the Cabinet Office guidelines. Do you think they are good guidelines? Are they widely known so that people know whether things are likely to be approved? They do stress that it should be possible to make fairly early application of the results of the research. How does anybody assess that?

A. In my view, my Lord Chairman, they are rather good guidelines. They are generally available to the research council community. I know that the heads of research councils are well aware of them. I hope that the executive officers and members of the research councils are also well aware of them. I do not myself read into them any particular emphasis on the exploitation of research. I am afraid I am therefore somewhat at a loss in answering that part of your question.

Baroness Nicol

634. Could I ask whether Sir David feels that British scientists are disadvantaged either by the shortage of money, which we seem to come up against, or by the complications involved on our side in making new arrangements?

A. There can be no doubt if we make comparisons between public investment in science in this country in terms of the proportion of GDP, for example, and the investment in other European countries, we come out rather badly at the bottom of the list. Given the rising costs of almost every branch of science, that suggests that we may be at a disadvantage. I have to add to that, that the financial input to science programmes is a very important part, but it is not the only determinant of scientific quality. One also has to consider the way in which

science is organised in a particular country, and the inherent quality of the scientists engaged in it. So there is between inputs and outputs something of a black box which differs from country to country, and which is not particularly well understood in any country. If you look across at the outputs from this country it is disturbing. If you use a rather crude measure like the citation index and the crude measure of the impacts of science from that index, then it looks as though our levels of basic science outputs are tending to fall both in quantity and in impact, but of course from a rather high level.

635. Over what period of time are you talking about?

A. There has been a progressive decline over the last 15 years or so, I would say, but, I repeat, from a rather high level at which we were second only to the United States both in the volume of science we produced and in the impact that it had. The other thing I would want to add to that is that my experience in Europe and elsewhere is that British science is still very highly regarded. When I go to the meetings in Brussels, for example, it is noticeable that the other countries wait eagerly, or even one might say anxiously, to hear what British scientists say in their referees' reports about the quality of scientific proposals that are being looked at in a European context. I think our standing in world science is still very high, but I fear that it is declining.

Chairman

636. When you say that applies also to what we get out of international collaboration, one can take the space field as one example. But if you take others, do you think we get as much as some other countries do out of participation in international programmes?

A. In terms of basic science, and also in space related science, there are areas, X-ray astronomy for example, in which the United Kingdom scientists lead the world. If you are asking about technological advantages of being involved in the international programmes, I think it could be said historically that British Aerospace had benefitted initially a great deal from the early scientific programmes involving space, and that that had gone on to give them some sort of an advantage the later development of satellites and so on; although that, as you will know better than I, in the later stages involved a great deal of Ministry of Defence investment. In that particular area, both scientifically and technically, I would say the United Kingdom did very well.

Lord Flowers

637. There was something I did not quite follow along the lines that, the regard in which British scientists' opinions are held is perhaps going down a bit these days?

A. I said that was still very high (and I have no indication that it is actually diminishing) but that I think there is evidence of a decrease in the volume and impact of published British science.

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[Continued]

[Lord Flowers *Contd*]

638. You are talking about the quality of British science rather than the regard in which it is held, so to speak?

A. I am talking about statistical measures of volume and impact as compared with the regard in which individual scientific leaders in this country are held internationally.

Lord Kirkwood

639. Returning to the funding of the international scientific projects, do you think there is any virtue in proposing that that should come from the budget of some other department apart from DES, for instance the Treasury? I am thinking of projects like CERN where large changes in the rate of exchange can affect the science budget.

A. That is, with respect, a proposition that has been somewhat discussed. I myself find it very difficult to believe, since all our resources pass through the hands of the Treasury, that putting the responsibility for CERN, say, in the hands of the Foreign and Commonwealth Office would actually in the end make any real difference. The difference it would make would be that the scientific control in any sense would be lost. I know that it looks as though that is the way that very expensive high energy particle physics is funded, say, in France. What I find hard to believe is that within the French system account is not taken of expenditure through the Foreign Office as well as expenditure through other agencies in arriving at a view of the overall expenditure on basic science. I am afraid I do not see any advantage in that backdoor approach.

Lord Kirkwood] Would it not protect the Research Councils from changes in rates of exchange? That is one of the criticisms which has been levelled at the way the present funding is carried out.

Lord Flowers

640. In either case the Treasury would have to invent a formula. It is a purely technical matter they have fallen down on, or do not want to tackle.

A. To an extent that has been settled, because the Science and Engineering Research Council is allowed to buy forward on the foreign exchange market. They have perhaps, from time to time, not been as expert as they might have been in doing that. The Treasury may to some extent still be somewhat inhibiting about the freedom they have in choosing their date to do that, but there is some flexibility available. As Lord Flowers said, that I think would apply whoever was responsible for paying for this particular budget.

Chairman

641. Do you think we ought to have hosted more major international scientific projects other than JET? Would it have been a good thing?

A. I find it rather strange that in some countries, France particularly, there is seen to be an overall national benefit in hosting international projects of

that kind, whereas in this country the Treasury takes the view that there is no macro-economic benefit in hosting such international ventures. There may be no contradiction between those two views; it may be that the French attach more importance to the international prestige they gain scientifically from hosting such laboratories, and it may be that the Treasury pays insufficient attention to various aspects of the economic balance. I find it surprising that one country comes out with a view that is so directly opposed to another comparable scientific country.

642. Which side are you on yourself?

A. I would have to wonder how this would impact on the science budget overall. The sort of thing I suppose that worries the Treasury and everyone else about JET is what the costs involved in decommissioning the laboratory will be. That may be a particular problem with JET which would not apply, for example, to the new European Synchrotron Radiation Facility. I am sure this is an important issue and that it presumably ought to be covered by the sort of guidelines that the Cabinet Office put out: thinking in advance of the problems which are going to arise; and ensuring that everybody plays a part in bearing the cost. Yes, I do think the United Kingdom should think more seriously about hosting international scientific projects.

643. Is it possible to express an opinion or preference about the best way of doing international collaboration between one method, something like CERN or EMBL, a totally international laboratory, and other methods such as the European Science Foundation where everybody finances their own? Or is it just dependent entirely on the particular type of collaboration you are engaged in?

A. I think the latter. I think with CERN it is hard to envisage that one could have set about continuing a European involvement in high energy particle physics by a different process from the one of drawing together in the financing of a rather large and elaborate experiment. That is not to say, I think, that this has been managed as economically as is humanly possible, but nevertheless it is a very successful laboratory. The European Molecular Biology Laboratory is really a different matter. It was hoped at the outset that the Laboratory would be much involved in the development of apparatus for the further development of molecular biology. It has not, it has to be said, been particularly successful on that front. It is successful as a general laboratory of molecular and cell biology but it does not necessarily have to be an international laboratory in order to achieve that.

644. It could have been a national one with international participation?

A. The Laboratory of Molecular Biology in Cambridge, for example, has always had a large number of foreign post-doctoral visitors passing

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through it, and they have contributed a great deal to its work. It happens they have mostly been people from the United States.

Lord Porter of Luddenham

645. What about the large instruments at Daresbury and the Rutherford Laboratory? Are we getting full national advantage from sharing those internationally? ISIS and the synchrotron radiation?

A. I think I would want to distinguish between the two. I think the synchrotron radiation source at Daresbury was built at a time when Britain had a sizeable scientific community with an interest in using that; and initially the experiments, if I have the time right, at Hamburg had shown a potential usefulness for the device. It has by now built up, I think, a considerable international scientific reputation, and the Dutch and the Swedes participate in the use of it. It is a very considerable UK resource which is shared with other countries. ISIS, I think, is a somewhat different story. ISIS was embarked upon, and Lord Flowers can no doubt correct me if I have the chronology wrong, at a time when the UK was already involved in, or thinking of being involved in, the Institute Laue-Langevin at Grenoble. It provides a particular sort of neutron source, namely pulsed neutrons, which there was not at the time a large scientific community ready and waiting to use. That community is undoubtedly developing. The French and the Germans and the Japanese and others have all by now contributed to the development of ISIS. I still wonder whether, given the continuing existence of ILL, there is not an over-provision of neutron facilities; and that is something which the Science and Engineering Research Council will have to consider very hard.

646. Is the contribution you referred to a significant one?

A. The French, German, Japanese one?

647. Yes. Financially, I mean.

A. It adds up to about 25 per cent of the cost, I believe.

Lord Flowers

648. To add a word to what Sir David said, both those projects, the synchrotron radiation at Daresbury and the neutron facility at ISIS, started with a fair element of jobs for the boys.

A. Yes.

Lord Flowers] There was a high energy accelerator laboratory which had to be closed down and it was a question of what to do with it. As Sir David said, in the Daresbury case, there was a community of synchrotron radiation scientists ready to make use of something. In the case of ISIS, there was not that community. I am glad he thinks that it has now built up sufficiently to justify it; but there was a very strong element at the beginning of jobs for the boys.

Lord Lewis of Newnham

649. Is Sir David happy with the way SERC goes about supporting science?

A. I think, Lord Lewis, we are living in rapidly moving times. SERC is at the moment engaged in an agonizing review of its portfolio of activities and is earnestly considering whether there has not been recently an over-emphasis on support of big science.

Chairman

650. Sir David, you mentioned just now there were advantages in foreign scientists coming to laboratories here. Is the low level or comparatively low level of salaries in this country a serious bar to that?

A. A good many of the foreign scientists who have in the past come to work, for example at the Laboratory of Molecular Biology, have been supported in various ways by American charities. That is one of the reasons why a large number of people were actually from the United States. They, in comparison with their colleagues in Cambridge, were often rather well off.

The Royal Society would have rather more evidence than I on whether, in their existing schemes with Europe, it is increasingly difficult to attract young post-doctoral fellows from their European partners to come and work in this country. But I do not think the Royal Society has provided the ABRC with any evidence that that is the case. I think people are still prepared to come and work here on United Kingdom science.

Lord Porter of Luddenham] If I may give a quick answer, that is very true and, in fact, we are the most popular country to visit within Europe from other European countries.

Chairman] So the salary levels are not a discouragement.

Lord Dainton

651. Helped, I think, by the popularity of the language. Might I ask one question because, as this conversation has gone on, I think I understand what Sir David has said to us, which is simply this. Given the smaller envelope of expenditure for a country of our size as compared with other countries, playing our part in international projects by whatever means, apart from those small things for which the money is already available in categories 1, 2 and 3 which you mentioned, does mean that the rest of science in Britain does have, as it were, pressing on it a larger force than would be the case in other countries?

A. Yes.

652. As I understand it, the Science Vote is to get more money this year at any rate as a result of transfers from the Universities Funding Council. On paper that looks as if it will relieve some of your problems and take some of the pressure off small science but then I am told—and this is what I would like to know from you—that much of that money

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[Lord Dainton *Contd*]

will, in fact, be used by universities charging greater overheads, equipment used and so on, so that really it will have no net benefit in terms of increasing the scientific activity which the research councils can afford to pay for. Is that a correct analysis?

A. Yes. In terms of research supported in the universities by the research councils this transfer will have a neutral effect. University scientists will in future expect to get back the full costs of research—except for premises expenses and university staff salaries—from the research councils, rather than expecting to get a proportion of the costs from their host institutions.

653. So this will have the effect of the universities themselves having less free money, as it were, to cultivate the seed corn amongst the younger people, who tend not to apply because they do not think they are of sufficient weight—shall we put it that way—to the research councils to be successful?

A. No. That question implies that universities have actually been misusing the money and have not been supporting the research council projects at the level they were supposed to do. Universities will continue to get an element of the support for research from the Universities Funding Council which will enable them to continue to support seed corn research before it gets to the level of needing research council support.

654. But presumably the contracts will have to be so broadly drawn that some of that money which is in the overheads can be used for cultivating seed corn, otherwise the arithmetic does not come right, does it?

A. I think so.

655. There is a rider to this, Chairman, and that is simply this. I have heard it said that, as a result of the pressures on small science and because of the Framework Programme, it is easier to get money for those very good self-generated projects in this country which go to the European Commission for collaborative work with other universities in projects which, though good, because of the exigencies of

funding here would not command support from the research councils; in other words, there are some alpha quality things which can only be funded in this roundabout way. Is this correct?

A. The stringency of judgment on the Framework SCIENCE Programme projects in my opinion was at least as severe as judgments by the research councils on United Kingdom projects. I do not really think anyone would believe that it was easier to get money for scientific programmes by the European route than it is within the United Kingdom. There is a further problem, that the European money usually provides less than 100 per cent. of the costs, so that accepting a European contract imposes a burden on the host university and if they accepted too many of those they would go bankrupt.

656. And that burden will get worse the more money is transferred from the UFC to the centre?

A. No. I think, Lord Dainton, if I may say so, you are misunderstanding the purpose of this transfer. The purpose of the transfer is to make the research councils responsible for seeing that their project grants are properly funded instead of leaving it as it is now, as a shared responsibility between the research councils and the university. There is evidence that quite often the university does not provide the part that it is expected to provide.

657. But it does mean the university having less money if it takes any European collaboration?

A. But the money that it has lost should not have been used to support other European or industrial contracts. That is exactly the point.

658. Yes, I understand that. I do not think it will be perceived (to use your own term) in those ways in the universities.

A. I think it will be made perfectly clear.

Lord Dainton] Their perception may differ from your clarity!

Chairman] Sir David, we have kept you at it for practically an hour and you have made a good many things perfectly clear. Thank you very much indeed. It is very good of you.

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[Continued

Memorandum by the Medical Research Council**INTRODUCTION**

The Medical Research Council's major policy objectives in the area of international co-operation are to participate in those activities which contribute to the development and implementation of the Council's scientific policies, and to assist in developing, for the UK academic community, scientific opportunities which cannot be provided within the UK. Towards this end MRC participates in a number of international scientific programmes (ISPs) in a variety of forms, ranging from formal financial commitments on behalf of HM Government, to participation of MRC scientists in European Community (EC) and European Scientific Foundation (ESF) networking activities and programmes.

MRC's formal commitments on behalf of HM Government include payment of the UK subscriptions to the European Molecular Biology Conference (EMBC), European Molecular Biology Laboratory (EMBL) and International Agency for Research on Cancer (IARC). In addition, MRC provides the UK delegation to governing councils and management committees for various ISPs including EMBC, EMBL, IARC, the Medical and Health Research (MHR) programme (with DH) and Human Genome Analysis programme of the EC Framework Programme, and the European Medical Research Councils (EMRC) standing committee of the ESF. A brief description of the ISPs with which MRC has formal links on behalf of the Government is given at Annex 1.

These ISPs undertake work in a variety of different ways; in the case of EMBL research projects are funded and conducted in-house, whereas the EC MHR programme (at least at present) and the ESF function to co-ordinate research activities which are funded nationally. In addition both the EC and ESF support training programmes.

Scientific research is inherently international; it is therefore fundamental that when an ISP is established the mode of operation and programme of work should aim to build on existing links in order to avoid duplication of, or competition with, national priorities.

MRC's perception of the advantages and disadvantages of participation in ISPs varies according to the basis on which each programme was initiated and has subsequently operated. The replies to questions below will therefore make distinctions between different types of ISP where appropriate.

(i) The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutes.

The main advantages of involvement in ISPs for the MRC are related to MRC's role as a funding agency, and are as follows:

- (a) The promotion and enhancement of international networks of scientists. Such networks can operate to maximise the use of national resources and research effort, ideally generating added value, that is, making progress which could not be achieved by any single nation.
- (b) The ability to undertake research of a scale and complexity which the UK alone could not support. This may be for reasons of scale and commitment (e.g., some multi-centre clinical trials) or for reasons of complexity and/or cost (e.g., the human genome programme).
- (c) The procurement of financial support from overseas grant giving bodies, such that it is possible to increase the scale of UK medical research.
- (d) Access to manpower with expertise which is unavailable or scarce in the UK.

The principal disadvantages are:

- (a) A mismatch with national priorities can occur where the interests of other member organisations prevail over those of the UK; this can result in ISPs undertaking work which duplicates or runs counter to UK national priorities.
- (b) A similar lack of co-ordination with national priorities can arise as a result of the inadequacy of existing mechanisms for establishing an overall UK strategy towards priorities in international collaboration.
- (c) In some cases management arrangements for implementation and evaluation of the programme are inadequate (for example some elements of the EC Framework Programme). These arrangements should include direct involvement in the management processes, application of rigorous standards for international science through peer review, and evaluation procedures that allow the termination as well as the starting of projects.
- (d) Participation in ISPs may lead to constriction of the domestic budget, e.g., the EC Framework Programme, where as a consequence of the Treasury rules of attribution Departmental budgets are required to meet the full costs of the Programme.

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(ii) *The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institute.*

The MRC does not at present host any large facilities in the sense of major plant, etc., and is therefore not well placed to comment on this aspect. However, there are increasing opportunities for UK European institutions to act as European “resource centres” in particular areas under the Framework Programme (e.g., Human Genome Analysis Programme) and the MRC would react positively to such openings provided they were economically viable and not at the expense of access by UK scientists to the facility in question.

(iii) *The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate.*

The machinery employed to set up ISPs varies according to the origin and objectives of the initiative.

For politically driven “top-down” initiatives negotiation with participating countries is often conducted by the Cabinet Office, with advice from the relevant Departments. The MRC may be invited to provide input via the DES and possibly DH. This flow of information may satisfy the political objectives of the exercise. However, it can also serve to inhibit the extraction of maximum scientific benefit from the collaboration. This is because the input from the scientific community is too remote from the ultimate decision-making point in the process of planning and implementation of new ventures. In the interests of greater cohesion of national scientific priorities the MRC would like to see stronger strategic scientific input to the establishment and running of ISPs, perhaps through the mechanisms of an interagency committee, to ensure that the UK approach to such ventures is set within a true framework of national scientific priorities. A good example of where such a development might work to the advantage of the UK would be in negotiations over the EC Framework Programme where, despite a developing consultation network, there still remains a fundamental lack of strategic scientific direction.

Alternatively, science-led “bottom-up” initiatives for international collaboration may arise with minimal input from Government. This category of initiatives includes the activities of self-appointed groups of scientists, such as EMBO and HUGO (Human Genome Organisation), which do not involve direct funding, and also networking activities undertaken under the auspices of the ESF. ESF activities are particularly attractive to the MRC because the management structure incorporates representation of national funding agencies, and therefore allows for co-ordination with national priorities. ESF also operates an “*a la carte*” approach whereby member organisations can choose whether or not to participate in specific programmes against a background of peer review and domestic priorities.

In general, the MRC’S experience is that the decision-making machinery currently employed is appropriate to the main objectives of each ISP, i.e., Cabinet Office for fundamentally politically driven programmes, such as the EC Framework Programme, and Research Councils for scientifically driven programmes, such as those within the ESF. However, for both types of initiative there is a need too for an effective mechanism for co-ordination with national scientific priorities and for transparency of management in order to achieve maximum scientific benefit.

(iv) *The technical and financial criteria under which proposals for ISPs are presented and considered.*

As for (iii) above, the selection of an ISP is to some extent influenced by the political versus scientific objectives of the programme. But there are elements which the MRC sees as essential to any ISP regardless of its origin:

- (a) The programme must fulfil the principle of “subsidiarity” or “added value”, that is, it must provide opportunities for research or research training which cannot be provided equally well or better in the UK. Thus, for example, the MRC has identified the following areas as appropriate for support under the Biomedical and Health Programme of the EC Third Framework Programme:

- Training.
- Epidemiology.
- Health services research.
- Multicentre trials.
- Multi-disciplinary teams in areas where local skills are in short supply.
- Targeted areas with special needs such as AIDS and human genome analysis.
- Adverse drug reaction and surveillance and monitoring.

- (b) Where the UK subscribes to a common pool, the management processes of the programme must allow a degree of control over the allocation of funds to satisfy the principle of accountability.
- (c) Scientific quality should remain the principal criterion for determining the allocations of funds and ISP management mechanisms should include independent peer review and evaluation to assess both scientific quality and cost-effectiveness.

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[Continued]

(v) *The forums in which the decision to participate in ISPs is normally reached.*

See (iii) above.

(vi) *Government practice and guidelines of ISPs—how they apply and how widely they are known and accepted.*

The MRC is aware of and accepts Cabinet Office guidelines for international collaboration issued in 1989.

(vii) *Treasury rules of additionality and attribution—how they apply in respect of ISPs and the Science Budget and how they treat the inflow of foreign money.*

The MRC would like to see greater flexibility in the attribution system for the EC Framework Programme in order to minimise the potential impact of EUROPES arrangements on UK funding priorities. This should take into account both the Research Councils' limited influence over the size of the programme and its political function.

The costs of the subscriptions to the EMBC, EMBL and IARC are included in MRC baseline funding and are not therefore subject to Treasury rules on additionality and attribution.

(viii) *Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative to UK salary scales, housing, travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions.*

The MRC would identify the cost of participating in ISPs and the impact on funds available for research in the UK as the main impediments to engaging in ISPs. Unlike other European countries, UK involvement in European ventures is generally at the expense of national programmes, an inhibiting factor at all stages of negotiation and prosecution of programmes. A second area of concern in the problem of currency fluctuations in the payment of UK subscriptions.

(ix) *Impediment in other countries to their engaging in ISPs (EEC, Commonwealth, USA, Eastern bloc), e.g., concern with national benefit and protectionism, problems posed by national budgeting procedures.*

The MRC has no direct experience or knowledge in this area and is not therefore in a position to comment.

MRC PARTICIPATION IN INTERNATIONAL SCIENTIFIC PROGRAMMES

1. *European Community Framework Programme*

- Established** : First Framework Programme 1984-87; legal basis in 1987 revision of EC Treaty by Single European Act. Articles 130f-130g are the foundation of the research and technological development policy.
- Cost to MRC** : Indirect, through attribution to DES.
- Activities** : Shared cost, concerted action and training programmes in all areas of scientific and technological research. MRC provides UK representation on management committees of the Medical and Health Research Programme (with DH) and Human Genome Analysis Programme.

2. *European Molecular Biology Conference*

- Established** : 1970, by intergovernmental agreement.
- Cost to MRC** : MRC pays the UK subscription to EMBC (£568k in 1990).
- Activities** : Courses, workshops, fellowships, travel grants.

3. *European Molecular Biology Laboratory*

- Established** : 1974, by intergovernmental agreement.
- Cost to MRC** : MRC pays the UK subscription to EMBL (£2.6m in 1990).
- Activities** : Basic research in molecular, cell and development biology.

4. *European Science Foundation (including European Medical Research Councils)*

- Established** : 1974, nongovernmental.
- Cost to MRC** : Approximately £167k in 1990.
- Activities** : Promotion of international collaboration through workshops, networks, programmes.

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[Continued

5. *International Agency for Research on Cancer*

- Established** : 1965 by WHO statute.
Cost to MRC : MRC pays UK subscription (£520k in 1990).
Activities : Multidisciplinary programme of studies in environmental carcinogenesis; research training fellowship programme.

6. *Commonwealth Caribbean: Medical Research Council*

- Established** : 1973.
Cost to MRC : None. MRC administers the UK contribution on behalf of ODA (£19,000 in 1990).
Activities : Advises on medical research in the region, and administers research grants.

Examination of Witnesses

DR D A REES, FRS, Secretary, and DR D EVERED, Second Secretary, Medical Research Council, called in and examined.

Chairman

659. Dr Rees, I thank you and your colleague very much for coming here this afternoon to give evidence to us and thank you also very much for your very clear written evidence which you submitted to us. You can see who we all are but you may not know our specialist advisers, Dr Mick Lomer and Professor Roger Williams. If you would like to introduce yourselves and make any introductory statement in amplification of your paper we would be delighted to hear it?

(*Dr Rees*) Thank you very much. I am the First Secretary of the Medical Research Council and my colleague Dr Evered is the Second Secretary, and our personal involvement in European structures, which is part of the issue that I understand you want to address today, is rather different. I am involved directly in European Science Foundation matters and Dr Evered is involved in the Community science programmes, so that I think we will share the answering process between us depending on the nature of the question. I think it is useful in talking generally about international scientific programmes to distinguish between two extreme types: those that are scientifically driven, that is, they are set up in order to achieve some scientific purpose, and those—and I use the word in a neutral sense and not perjoratively—which are politically driven. An example of the first would be our Anglo-French collaborative projects on AIDS, where, in order to carry out a drug trial, to get enough patients to make a statistically meaningful trial we have to pool the patient resources of the two countries and we do the job better together than we could do separately. Or another example might be sequencing the genome of the nematode, which is an Anglo-United States project, which again is a task of such scale and involving such complementary expertises that we can do it better together than we could separately to establish an important model study for the human genome. So in the scientifically driven projects we each go into the exercise because we know what we want out of it and the rules of the game and the success or failure are very similar, (except for questions of scale) to those which determine the success or failure of any collaboration within a single country. Admittedly, later on when the interests of the partners begin to diverge, as often they do and especially if you have made a heavy investment in

plant and hardware, then it gets more complicated but I will not go into that—there are other research councils who have more experience of that than we do. Moving on to the second type of international scientific project, those that are politically driven (which is where we as a Council have more problems to sort out), the best example and also the example which causes most concern is that of the European Economic Community. Here science is being used—and I am not saying this is a bad thing—as a glue in order to help to cement the bits of Europe together, to improve communications and so on, to accelerate to some end state where science hopefully works better. But the projects are not in the first instance set up solely to achieve an important research goal. I think these raise a number of practical and managerial problems which we in this country have not yet learnt to cope with very well. The problems are in two areas. One is that the translation of the political will to achieve a higher degree of collaboration in Europe in scientific issues originates in Brussels by processes that are not entirely transparent to us, processes which we think we should have more input into, which we should influence more and which it would be in our interests to influence more. Secondly, those proposals, having emerged from the Commission, are dealt with, coped with, responded to, within the United Kingdom by processes which involve a lot of interests, different research councils, different government departments and involve national policy in the Foreign Office and the Cabinet Office and so on. So to respond effectively we need to get our act together and that is another area in which there is room for improvement. Finally, I would say that, of course, European programmes do not come for free; the United Kingdom contributes to them. The present policy is that the costs of these programmes are attributed to departmental budgets, including now the Department of Education and Science, which effectively means that money comes out of research council budgets in order to fund these European exercises. That makes it all the more important that we get these European programmes to work well because otherwise we are substituting poorly organised research programmes for activities which we run perfectly well ourselves at the present time, so that the value for money could, in fact, go down.

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[Continued

[Chairman *Contd*]

660. Can you give an example in your own field of where your budget has been seriously affected by having a European Framework Programme in your field attributed to you which you would not have put money in or would not have wanted to put so much money in?

(*Dr Rees*) There are certain programmes which are attributed to the Department of Education and Science. They are those programmes for which the DES has the lead responsibility and then it is for the DES to decide how to pass on the costs to the research council system.

661. So you reckon your Medical Research Council allocation has been less than it would otherwise have been because the DES are having to pay for European programmes?

(*Dr Rees*) Yes.

662. Is it because they are supporting something in your own field in the European programmes or in another field?

(*Dr Rees*) In our own field, recognised to be in the area of interest of the research council system, and that is why it is done. I do not think there is any possibility, is there, of arresting this process in Brussels? There might be a question as to whether this process of attribution should occur, that is, whether the programmes should be instead of national programmes rather than as well as.

Lord Flowers

663. Could I ask Dr Rees to be a little bit more specific. Are you really saying there have been serious cases, not trivial ones, where effectively your money was spent on things which you would rather it had not been spent on?

(*Dr Rees*) No, not yet, but this year is the first year. Up till now most of the European programmes have been of a rather applied nature, so that, for example, biotechnology has been attributed to the Department of Trade and Industry until its recent partial transfer to Education and Science. European programmes are now moving more in the direction of basic science, which is the proper province of the research council system, so that for the first time this year a top slice has been taken from the research council budget. It is only of the order of several million pounds but as the programmes increase this amount is bound to increase and it is a cause for concern, something that we have to watch.

664. Have you any reason to suppose that money will not be spent as carefully as you would have spent it, or is it just about distrust of foreigners?

(*Dr Rees*) No. The point I am making is a different one, Lord Flowers, that if this process is going to occur then we should equip ourselves better to make sure that the direction and management of those European programmes reflect our interests and our priorities, and at the present time we do not do that very well.

Chairman

665. When you say "we" do you mean the Medical Research Council or do you mean the Government or the research council organisation as a whole? Do you not yourselves have an input into Brussels?

(*Dr Rees*) I would say that the Medical Research Council is in a slightly different position, and my colleague will speak about this in a moment, because there are two European programmes in which we are involved. One is the Medical and Health Programme and that is smaller and more tightly organised and on the whole more satisfactory.

666. That is an ESF programme?

(*Dr Rees*) No, the Medical and Health Programme.

667. A Community programme?

(*Dr Rees*) That is right, and then there is the Framework Programme as a whole and that is the area about which I am more concerned. I am saying that the research councils do not have as much influence on it as we should in our own interests and in the national interests, but I am not necessarily saying that it is our own fault. It is because the mechanisms we have in place within this country do not allow us to make the quality of input that I think would be helpful and because within Brussels, where the programmes are originating, we do not succeed. Perhaps it is the old story of Britain just not trying hard enough, but we do not have as much influence at the beginning.

Lord Dainton

668. Am I right in understanding, since you did refer earlier to what I imagine was part of your Framework Programme, namely, social cohesiveness, that that is something which in a sense you feel you would have liked to have a good deal of opportunity to discuss before it was determined?

(*Dr Rees*) Yes, line 6, the human capital and mobility programme.

669. On the other hand, I suppose it would be very difficult to take any moneys which are being used for that purpose and attribute them to any particular department in this country, would it not, so that you might be unaffected financially by attribution?

(*Dr Rees*) No, it has to be attributed somewhere.

670. Yes, but where?

(*Dr Rees*) If it is in basic sciences it is likely to be attributed to the research council system and then it is likely to be divided up *pro rata* proportionate to the scale of the budgets between the various research councils.

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[Continued

[Lord Dainton Contd]

671. So it is the detailed nature of the work which is done, not the general heading, which determines the attribution?

(Dr Rees) That is right. So that if we are going to have to spend a certain amount of money on human mobility there are certain ways in which it is better to do it than other ways and we would have to do this.

Chairman

672. You suggested it is the machinery which is at fault, and in your own paper you suggested the establishment of what you call an inter-agency committee. What do you see this as being, and what do you see as its relationship to the ABRC and to the Cabinet Office Secretariat?

(Dr Rees) It would involve the ABRC. We say in our paper, I think, that the actual machinery is not important, but what is important is to achieve the end of having a focus for UK influence on European programmes, and many people have argued for example that we should have a Minister for Science rather than having the scientific responsibility divided up between the various government departments. Others would say with the shift (and I have a great deal of sympathy with this) of emphasis of European programmes towards the basic sciences, we should look to a DES minister rather than a DTI minister taking the lead role. Alternatively, if you keep the structures the same at that higher level, I think there has to be a mechanism which operates at chief scientist level at least to get the points of view together and produce a single point of view which then equips whoever it is who goes to Brussels to represent a single national position this would be an interagency committee based on the ARBC.

673. You do not think the science and technology secretariat in the Cabinet Office under the chief scientist is doing that, or is not doing that properly?

(Dr Rees) I do not want to be the new chief scientist's adviser, and I would not wish to criticise him in any way, nor the old one.

674. That is the office which is supposed to be doing just that, is it not?

(Dr Rees) Yes.

675. You say it is not doing it properly?

(Dr Rees) I do not think the end product is being delivered.

Lord Adrian

676. Could I change the direction of sight slightly and refer to the HFSP, which is a small programme but one which was set up some time back from the top-down. I have to come clean on this and say I am a member of the scientific

committee, and I think I was first approached (although it has to be said it was somewhat vague as to who actually made the approach) by the Royal Society to ask me whether I would be on that committee and then I was approached by the DES. In view of what you say, I am a little surprised because there is a mechanism in this case. There are two scientists, Sir Walter Bodmer and myself, on the scientific committee and I have not been approached by the MRC. If the MRC were anxious to have a scientific input, one is there, but maybe one is not at the right level to be spoken to, as it were?

(Dr Rees) Certainly, but I think the HFSP is totally different from the Community programme.

677. I entirely agree, it is different.

(Dr Rees) There are two trustees in addition to yourself and Sir Walter Bodmer, who represent the DES and the research council system, and we make our input through them rather than directly to the independent trustees, yourselves. I am totally content with those arrangements as they exist. There is a world of difference between the HFSP, which started off as a sort of quasi-philanthropic exercise to make more money available (it may not be that now and many people suspect it to be a Trojan horse for something else but nevertheless the theory was it was a quasi-philanthropic exercise which would make more money available to science) and who could be against that? Whereas the EEC process is politically-driven, it is about orchestrating us to work more together and using some of our own money in the process.

678. I entirely take the point, my Lord Chairman, that the enterprise is small, but the point I was making was that I was in a sense slightly concerned that although the MRC was saying they wished more scientific input, it was not something, from my personal experience, they had exercised, though I entirely take the point there are other trustees with whom the MRC have contact.

(Dr Rees) We were in fact directly instrumental in agreeing the areas in which HFSP would operate.

Lord Adrian] I appreciate that.

Chairman

679. Would it not be true to say, on the whole, that you do not like the European Framework programme at all and you could very well do without it in your field?

(Dr Rees) I am a practical research administrator. I think the Framework programme exists, we have to be part of it, and we have to make it work properly. We are not doing that now, that is my point.

680. You talk about the fundamental lack of strategic scientific direction in it. Is that bound up with what you said before, that we do not get an input into the stages at which the Community makes proposals?

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[Continued]

[Chairman Contd]

(*Dr Rees*) The fact is that projects do originate within the Commission by a mysterious process of consultation and somebody somewhere having an idea; this is not an open process. When we in the Medical Research Council or the Advisory Board for Research Councils think about increasing support for an area, we think about what other areas we could support, we argue openly about which is most important, where the priorities lie. We do not see that happening in Brussels. Maybe it does, but rabbits come out of a hat.

681. This is what you mean by "transparency of management"?

(*Dr Rees*) Yes.

682. Do you not have spies in Brussels to tell you what is coming out of the hat?

(*Dr Rees*) We try to have, but this is a question which I do not think the MRC can tackle by itself, or SERC by itself, or the DTI by itself. It is something we need to organise, hence we want a single voice.

683. Your answer is a Minister of Science?

(*Dr Rees*) Or a DES Minister, or an organisation at the chief scientist level.

Lord Flowers

684. Could I ask whether Dr Rees finds the European Science Foundation mechanism a useful one, not as a substitute but a useful mechanism? Dr Rees knows very well I once had a connection with it.

(*Dr Rees*) We place a high value on the European Science Foundation type of project and I am very active in that myself as chairman of one of the standing committees for medical research. I think the great strength of the European Science Foundation is that it operates by seeking to build on the activities of the member organisations, so we start from where we are, what we are trying to do and then, in a scientifically-driven kind of way, try and get our acts together. Its great weakness is that it does not have much of a budget.

685. Is it not possible to define a programme through the ESF machinery and then get it funded through the Brussels machinery?

(*Dr Rees*) A brilliant idea! I wish that could happen and there are people who, as you no doubt well know, are trying to do that now, to use a proportion of line six, human mobility activities and conference activities, to pass some of the management of those into the ESF. I understand they may have a certain limited success, and I hope they have. Another thing I wish would happen is that Brussels would use the effective European mechanism already in place, of the European Molecular Biology organisation which thinks it is under funded, and keeps asking us for more money which we cannot

afford. In Brussels they are sitting on piles of money wondering what to do with it. Why do they not take that effective mechanism and achieve their purposes through that? Those are the issues, if we can get into the discussions, which I think should be pressed.

Chairman

686. We had an impassioned plea from the EMBL that was the way to organise international programmes. Would you agree with that?

(*Dr Rees*) I think that the EMBL has a great deal to offer. I do not think that anywhere in Europe, including the EMBL, do they operate choices of scientific priorities as stringently as we do. We have become used, if we ever want to start something new, to having to stop something that is already on-going. That is an entirely novel thought for EMBL, so that if they want to start something new they ask the member organisations, including ourselves, to pay more, which means stopping something over here, and we find that very difficult indeed. So I think with that qualification there is some excellent science going on and it could do a lot more for Europe but it would be very helpful if the extra resource could come from the central European fund.

Lord Flowers] Dr Rees perhaps remembers that the electron synchrotron radiation facility was designed through the ESF mechanism and the money had to come from other sources, but the whole project went ahead because of that mechanism and it ought to be used more often, it seems to me.

Lord Porter of Luddenham

687. Could I clarify something I think I misunderstood when you said so strongly about European science being used as a glue to cement the European Community together. Are you saying that the quality of the science is less than it is in a national programme and the applications are, therefore, rather easier to come by than in a national programme, because you were here, I think, when Sir David appeared to state the opposite?

(*Dr Rees*) I happened to overhear Sir David. I think Sir David is actually personally involved in some of the projects and some of the processes as a member of CODEST, so that he will have a more first-hand impression than I. As an example from the Medical and Health Programme of unfortunate priorities, there were discussions within that Community programme about the areas and projects which should be started. There are perfectly good European collaborative arrangements for research in cancer at the present time but for political reasons the French thought it would look good to have a Community programme on cancer, so they have a programme on cancer, but in our view it would have been better to have had a programme on something which was in greater need of co-ordination and collaboration.

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[Continued

Lord Nelson of Stafford

688. Could I raise the question of the attribution system, which none of the research councils likes, as I understand it, but you ask in your paper for greater flexibility in this system. What extra flexibility have you in mind, Dr Rees?

(*Dr Rees*) I think it is operated rather rigidly. There is no discussion with us about what attribution we should take, what level of interest we really have in the activity, what it is appropriate to charge us for.

Chairman

689. In the evidence which was given to us by the Treasury they made the point that it was up to departments anyway, if not research councils, to argue, as it were, about the attribution made to them, to make representations, and we were given the impression that this was just like the annual bargaining process that goes on between every government department and the Treasury all the time. Does that not happen?

(*Dr Rees*) It does.

690. But you do not have any part in it?

(*Dr Rees*) No, the DES goes through that process on our behalf.

691. Do they not consult you?

(*Dr Rees*) Are you taking evidence from the DES?

692. They do not consult you?

(*Dr Rees*) Well

Lord Sherfield

693. You say in your paper that the consequence of the Treasury rules of attribution is that departmental budgets are required to meet the full cost of the programme. Is that so?

(*Dr Rees*) Yes.

694. The Treasury have told us at various times that of such money as comes from Europe only about two-thirds has to be met through the process of attribution and the result is that a third is, so to speak, an additional amount.

(*Dr Rees*) As I have said, one of my problems is that I am remote from the process. My understanding was and is that the full cost is recovered but it may be that that is incorrect or it may be that there are certain special circumstances which involve departments other than the DES where concessions are made.

Chairman

695. The Treasury claim that 35 per cent. of the actual Community cost of the project is not then attributed to the departments and 65 per cent. is. I think that is right.

(*Dr Rees*) It would be extremely helpful if the details of those calculations could be laid out and if we could have a chance to comment on them and discuss them.

Chairman] We have actually tried to but have not been able to get at how they work that out, but there is a piece of paper which we have.

Lord Sherfield] Yes, there is quite a lot. I asked that question because I wanted to be sure what, as far as the Medical Research Council was concerned, was the result.

Lord Nelson of Stafford

696. By "more flexibility" what you are really saying is that there should be more money forthcoming when the case is adequate?

(*Dr Rees*) Yes. If, indeed, that 65 per cent. does exist, there could be some flexibility about whether it should be greater.

Chairman

697. But when you say "flexibility" presumably you accept that money which has gone into research in the European Framework Programme must somehow be considered *in toto* against the sum of money which the Government is prepared to spend on research and development?

(*Dr Rees*) Not entirely. I think if part of the exercise is to achieve a political end, a very good political end, and the various governments in Europe are prepared to sub-optimize on the quality of the science, then there should be an extra contribution for the loss of productivity of the scientific system which is borne in order to meet that political end.

698. I think you would find it very difficult to get anybody to accept, what with the fact that all the projects are subject to peer review and so on, that there is an element which is purely political. It reminds me of the arguments I was very familiar with when I was Chief of the Defence Staff from the Navy which suggested that a deterrent force should be charged to the Foreign Office.

(*Dr Evered*) If I might respond to that, it is not the case that all applications are subject to peer review; that only applies to certain Community programmes.

699. Only to the Framework Programme?

(*Dr Evered*) No, it only applies to some programmes within the Framework.

700. There is one other point. I think you were here when I asked Sir David Phillips a question about whether salary scales in this country were a deterrent to foreign scientists and researchers coming over, and the answer we seemed to get was no, they were not. Is that your opinion, too?

(*Dr Rees*) It depends on the level. I think that at the higher levels it is a serious problem.

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[Continued

[Chairman Contd]

At the post-doctoral level, I think it may sound old fashioned but the sort of person we want to come over here is the highly gifted and scientifically ambitious young scientist who wants to go to the best institutions in Europe, and we still fortunately have some of the best in medical research, and he will live as the natives live, if that is what is on offer. As Sir David said, actually a number of them come on international fellowship schemes, charitable schemes, where the rates are set in their local countries or as EMBO fellowships across Europe, and they suffer no penalty. At the higher level, our senior scientists take senior posts in the Pasteur Institute and in Denmark and elsewhere and naturally we look for exchanges in *quid pro quo*. I can say that we have recently attempted to offer posts on one hand to a German and on the other to a Swiss—very distinguished—at our premier institution in Cambridge and the material rewards emerged as a real problem—pension rights and salaries. They have to be prepared to take a drop. By the time you get to that stage, where there is a family and children, as well as all the upheaval and language problems, a drop in the standard of living for your family is often the final straw which turns the possibility off.

701. Thank you very much. Dr Evered has not had much of a say, is there anything you would particularly like to say?

(Dr Evered) Perhaps just one point, going back to the European Community programme. I think it is important to emphasise there is some distinction between the medical programme and the many other components under Framework. I think there are two distinct differences. The first is that health was not a component of the Treaty of Rome. The result of that means the health related issues are dealt with by no less than eight directorates-general and that, as you will rightly appreciate, causes a number of problems. Secondly, we do have a direct input to the management committees in Brussels because we provide the DES input. We are more advantageously placed than the other research councils. This does of course give us some unique insights into the mechanism by which the Commission operates but nevertheless there are problems, a number of which we have touched upon. I think the counterpart of this rather long, attenuated process by which the scientific input from the UK gets diluted through the UK channels, is a similar process which occurs in Brussels as proposals go through the Commission, members of the European Parliament, CREST, the Committee of Permanent Representatives and the Council of Ministers, and that goes through two cycles, one for Framework and one for the individual programmes within Framework. That again gives a great deal of dilution and often leads to a distortion of the programme, which provides a challenge for those on the management committee to try and re-shape it when it is handed down in the form of a final Council decision. We have become very much more pro-active within the Council of

Europe, and have provided a great deal of what has gone into the technical annex of the two programmes where we have a seat on the management committees—the human genome and the bio-medical programme. A great deal of the content of those programmes was provided by the Medical Research Council. We still of course need to ensure the objectives which we have defined are achieved and again there are a number of problems which we have touched on, which I will not elaborate on—evaluation, project management and assessment and monitoring—but there are problems there which we are trying to involve ourselves in more actively. Our influence is limited for the reasons I have outlined.

702. In all this field how are the views of the medical research charities taken into account?

(Dr Evered) The answer to that is relatively little. We have of course relatively good informal relationships with the charities, both as a body and particularly individually, thinking of the larger medical research charities. So in that sense we are aware of many of their major activities.

There is, however, no mechanism for a direct input with respect to sharing the scientific strategy of Europe, non-charity.

703. Ought there not to be?

(Dr Evered) I think that question perhaps ought to remain open on the grounds that the attribution is back to the DES and the Science Vote, whether it is 100 per cent. or two-thirds.

(Dr Rees) I think it is an excellent idea if they chip in and then they can have a say.

704. It is very different in other fields of research, is it not, particularly in the cancer field, for instance, where an enormous amount of research is carried on outside the United Kingdom research councils?

(Dr Evered) Indeed, and, of course, we do have a major co-ordinating committee of which we and the two big cancer charities are the major sponsors.

705. So it would be in that committee that the question of participation in an international programme in that field would be considered?

(Dr Evered) It is not quite that specific. There is a general exchange of information about activities within Europe but we see it as our primary responsibility to try and ensure the development of programmes which are complementary to and contributory to national programmes, so that there is genuinely national and Community added value.

(Dr Rees) I think it is fair to ask whether there should be representation without taxation. We are taxed, they are not, so it is perfectly correct that they should be involved informally but as sensibly as possible.

706. Yes. I am thinking that if you are considering an international programme in a

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and DR D EVERED

[Continued

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particular field you want to take account of the people who are doing research in that field before you set up something else?

(Dr Rees) Absolutely.

Lord Nelson of Stafford

707. I was rather interested when Dr Evered said that the Medical Research Council has direct access to Brussels. Does that mean that you can move more quickly than the other research councils because of that direct contact?

(Dr Evered) We may be able to move more quickly, Lord Nelson, but it does not necessarily follow that the Commission moves more quickly, unfortunately.

708. I was rather thinking of the decision-making in this country. Others have complained how slow the decision-making process is in this country but they have not got your problems.

(Dr Evered) We can make a direct input and we do at various stages in the process, both in terms of shaping the strategy and in determining the management mechanisms.

709. Would you say that was an advantage?

(Dr Evered) I believe that to be an advantage.

(Dr Rees) Would you say also, David, it is an advantage having just one research council and one government department with an interest?

(Dr Evered) Yes. That is, of course, not quite the case because there is a Department of Health interest, although they are the minor partners.

(Dr Rees) I am sorry, I meant one other department than the DES.

(Dr Evered) Yes, I agree with that.

(Dr Rees) So it is really a microcosm. It is much easier to work on a smaller scale.

Lord Nelson of Stafford] Yes, it is not just the one.

Chairman] Dr Rees and Dr Evered, thank you very much indeed for your very helpful evidence to us.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Thursday 6 December 1990

MR B W OAKLEY

BRITISH TELECOM

Dr D M Leakey, Dr J E Thompson, Mr P Strickland and Mr K Gymer

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THURSDAY 6 DECEMBER 1990

Present:

Adrian, L	Nelson of Stafford, L
Carver, L (Chairman)	Porter of Luddenham, L
Dainton, L	Shackleton, L
Flowers, L	Sherfield, L
Kirkwood, L	

Examination of Witness

MR B W OAKLEY, CBE, called in and examined.

Chairman

710. Mr Oakley, we are very grateful to you for coming along and giving evidence to us this afternoon. We have entitled our study "international Scientific Programmes". That also includes international technology programmes and it is that field really about which we are thinking mostly this afternoon. Would you like to make an introductory statement on the subject or shall we go straight to questions?

(*Mr Oakley*) I think, my Lord, straight into questions would be best. May I simply say I believe the international programmes that the Commission has been running have been of very considerable benefit to both the industrial and academic communities of Europe.

711. How do you think people should arrive at achieving the right balance between national programmes and international ones?

A. Well, the simple answer is "with difficulty". But there are, I think, some lines that come out pretty clearly. It all depends upon the circumstances of the particular firm and the particular project. For example, standards work: it is almost always better to do that internationally for obvious reasons. I think that British industry would say, for large capital intensive projects, internationally is better than nationally. If you want to get users into the project in an important way, then very often it is better to do that in Europe because that will tend to spread the user base. On the other hand, the nearer to the basic end of the spectrum it is in general—there are certain exceptions—it is possibly better to do it nationally. On the whole, the more the project is concerned with technology as distinct from product or process, probably nationally. In my own view, to get started in university collaboration, it is much better to do it nationally or locally.

712. But these days, particularly in advanced technology fields, with a great deal of industry being international itself and not being national, is the right way to go about it through these European programmes like ESPRIT and EUREKA and things like that, or to leave it to what are largely international firms to work together?

A. When in doubt, I have little doubt that the international programmes are the right way to go for firms who are undecided, simply because of the other benefits that one does not first think of which really do come out of these projects. My own experience in

Logica is that we find international programmes a very good way of learning more about potential partners in Europe, about the academic scene in Europe. It is a wonderful way of getting on the inside of firms that one might have an interest in for one reason or other, to calibrate on them. But, of course, if one is able to do a straight deal with somebody on the Continent, particularly if it is a user supplier type deal, and get one's development support that way, then it saves all the bureaucracy and gets on with the job. I think we are talking about a field where, for one reason or other, we have not yet reached that stage—if you like, this awkward word "precompetitive".

713. How important is this precompetitive idea and is it possible actually to define it satisfactorily?

A. I have to say I have always defined it as whatever people are prepared to co-operate on in the research field, which is not a very tight definition! I think we have to be slightly careful with the concept in Europe, because I believe that we acquired the concept from the very successful programmes in Japan but the fact of the matter is that the European scene and the Japanese scene are not the same. Grossly to oversimplify, in Japan the problem is the need for basic ideas, basic science, if you like: in Europe—not just in the United Kingdom—the problem is shortage of capital or, if you like, the high cost of capital. Now, once one has faced that, then one finds the precompetitive concept is somewhat different. The Japanese, I think everybody agrees, they are superb at co-operating precompetitively and immediately going into the development and production phase and fighting each other in the marketplace tooth and claw. In Europe though, the chances are that what we are really trying to do is to reduce our overall cost, to find a better, a cheaper basis, if you like, for getting an expensive project to the marketplace fast. I think the reason why the information technology programmes have been so relatively successful in Europe is because of the short life of the product which means that speed is of the essence; there is no point in being a year later than your competitors in the information technology field. Under those circumstances there is a lot to be said for a collaboration which leads on to getting into the marketplace—if you like, emphasis on the exploitation side of things - whereas in Japan no doubt the emphasis really is on acquiring ideas which can then be exploited individually.

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[Continued

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714. But how about the preservation of intellectual property rights?

A. I have to say that I do not believe that has actually proved to be a problem in the field with which I am associated. In the pharmaceutical industry I could well believe it would be a very different matter, but in the information technology field the kinds of agreements that the Commission require for their programmes have been surprisingly non-contentious. They have caused alarm for everybody who has first come to look at them, but once one gets used to them and one gets to understand them, with relatively rare exceptions they have not been a problem. Essentially the basis is that in the precompetitive stage, while you are working together, you share in both the foreground and in the background property rights of what you are doing; when you come to exploit the whole consortium has to agree on the use of other people's property, and that just does not seem to have been a problem. There have been a few cases—I regret to say British cases—which have proved a problem, noticeably British Telecom and Imperial College. The French object in principle all the time but never in detail, and for the rest it has gone astonishingly smoothly.

715. Is that because many of the collaborative programmes are not between people who are actually competing directly with each other but are between people who are, as it were, concerned with different stages in the process of producing whatever you are working on?

A. In some ways. Of course, most successful collaborations have been those which have involved academics, industrialists and users, where the user is going to pull the innovation through the other stages. The French have been extremely clever at building up those sorts of collaborations and I think we are learning to do that.

Leaving aside the standards area, where quite a different world pertains, I think you are right that the most successful ones, the ones which perhaps the programmes increasingly evolve into, are not those where direct competitors are in it together, unless they already plan to collaborate at the competitive stage, if one can use that tautology. For example, JESSI, which is the last major microelectronics programme in Europe, involves the three remaining major firms, Thomson, Philips and Siemens, and it is not just a programme for R&D. They know the way forward to exploitation, essentially competing in some parts of the market but actually dividing the market up in other parts. That project started as a EUREKA project, though a considerable amount of it is now actually being funded under ESPRIT.

Lord Flowers

716. I wonder whether we can bring into slightly sharper focus the question of who initiates what. In one sense you can say that you can do things at the lowest possible level which you can get away with

—your own university or nationally or whatever—and then they go upwards and you really have to have reasons for money or facilities or whatever: or there are those who say, “No, you want to declare your overall objectives for European programmes in view of the needs of Europe,” and so on and work down that way. Both, I imagine, are not very practicable on their own but I wondered whether you would care to say where initiation does tend to lie in this complicated pyramid? I am talking about European programmes.

A. The way the scene has developed in ESPRIT and RACE is that the Community—academics as well as industrialists—get together to put together the work plan. In my opinion, there is actually a missing stage, a strategy stage, which so far we have not really been very successful at putting together in these so-called pre-competitive programmes, but the work plan does result in some objectives being stated which the Community as a whole agrees on, hopefully, with some indication of priority. That then gets published and that enables the universities, the firms, to make up their mind whether they wish to attack that programme. I am afraid that very often those work plans are sufficiently general that they do not create the type of priority pressure which I think we just have to face in many circles. Nevertheless, they are a guide and a firm like mine looks at the priorities there. If they line up with our priorities then, these days, we will try to lead the project because our experience suggests that if you can get into the leading position you are in a very much stronger position to get all you want out of it. Sometimes we are happy to join a project where we have a very minor role because we come in later. On occasions, though, we look at the scene and come to the conclusion that we do very much better to continue alone, or to continue in local collaboration with a university in this country.

717. So you are saying it is a top-down *a la carte* process, if one can put it that way?

A. Yes. The stage which is missing, to my mind, is going further and saying there are certain priorities for Europe. Clearly it is for the industrialists to say that and spell that out and then to give those key concerns the power to select from what is being put forward what to do. In the JESSI programme I have already referred to there is what is known as the Basic and Long-Term research part of it and this is almost entirely populated by academics, and quite rightly so, because it is facing a period like 1998 onwards where, frankly, only academics have any vision of what is likely to be possible. It takes one almost into the basic science. That seems to me to be quite a useful concept because it focuses the minds of the academics on something which industry has said it can see that it needs. It provides a sort of umbrella under which industry can in a sense steer the work and in particular, of course, spot something that is coming out of the work that is really important and

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then help to pull it through, and I would like to see more of that sort of steering in the international programmes.

Lord Nelson of Stafford

718. Mr Oakley, you have a lot of experience of international collaborative programmes. Would you have anything useful to tell us, do you think, about the different approach of other countries and firms in other countries from that in this country, and particularly their ability to make more use of them and get more out of international programmes than we do?

A. First, I would say that I think that the United Kingdom is pretty skilled at this game, for reasons which I am never totally clear on. It might just be language but I think it is deeper than that. We very often find ourselves in the driving seat in these programmes, particularly at the planning stage. I can remember one embarrassing occasion when we were going before the European Parliament and there were five separate sectors and at least four were led by Britain and it did not give an impression of a very widespread community. So I think the United Kingdom is quite good at getting the best of it. On the other hand, if one looks at the French—and I think in a sense I am referring to the French Government—the consistency with which they support their firms and their academics, the way in which there is always a French plan in the background where each firm knows what the other firm is going to do, that is orchestrated by the French government departments very much on the lines of MITI in Japan. I do not mean that the policy comes from the civil servants. I think the policy clearly comes from French industry but there is a degree of planning, if you like, in the French scene which, in my view, we lack. I do not know that that gives the French an enormous advantage but it often feels as if it does because so often they are clearer about their objectives and longer-term objectives and so on. In my own particular area of the software industry there is a certain coherence about the French software industry and their attack on these programmes which we can only envy.

719. Where would you feel the weakness lies? Where would you like to see it strengthened in this country to be more equivalent to the way the French do it?

A. To put it bluntly, I have to look to my old department. I consider the DTI should be taking much more of a catalytic role, a role which sees itself as the body which can help industry to pull together in a cohesive way. Clearly this is unimportant in a field where the individual firms can do their own thing and hope to thrive, but in a field like information technology where the international competition is extremely strong, the playing field is not level for one reason or other and then the role of Government in creating a national attack, even

though it is a national attack through an international programme, does seem to me to be very real.

Chairman

720. But given the aim of the European Framework Programme, which is really to build up a European capability to compete with America and Japan, and given the fact that many firms have links with American and Japanese firms, is there a problem in collaboration in Europe caused by links with American and Japanese interests?

A. There is an intellectual problem. As long as I can remember it has been a topic which has bubbled in the background and, of course, it is now coming pretty strongly into the foreground, not least because of the Fujitsu ICL situation. IBM, for example, has joined the programme that I have been using as an example, JESSI. My own view is that we simply have to face the fact that in the technology field we are now in a global game and it is quite useless to think of things in either national or even European terms. In those circumstances, it is quite ridiculous to be a "Little Englander" or even a "Little European". We just have to face the world scene and if that means having partners in our programmes who are based in the United States or Japan, so be it. That may actually be to our advantage. I have believed that a re-think of this situation is required by the governments of Europe. If anything, I think the British Government is in the lead in facing this globalisation. Certainly it was, strangely enough, rather one has to say, ICL which made the European IT industry face up to the fact that they were part of the world scene.

So my own view is that, providing the partners in a particular consortium are happy to have IBM, Fujitsu, or whoever it is in, providing those firms are, of course, working in Europe (clearly one must assume that they have actually got a European base not just for production but for R & D as well), then I think there is a lot to be said for their participation. In a way, the academic world has recognised this for centuries. The internationalisation of science has been there, I suppose, ever since the Greeks spread the word round Europe. Certainly it is one of the prides of science that in Napoleonic days scientists could travel freely across the European scene. I think we have to learn from that really in a game like information technology in the industrial field.

721. That is a very interesting thought. If one of the principal aims of the European Framework is the provision of common standards to do research so that you can operate a common market properly, do you think it should in fact be widened to look for common standards on a much wider basis?

A. Yes. In a sense I am worried about what has been happening in standards. I am worried about our success in standards. There is no doubt that one of the very clear achievements in these programmes has been that Europe has now become a real force in

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the international standards world. To take as an example PCTE, the common tool interface for software tools was established first of all from France but it spread very rapidly to the United Kingdom with the encouragement of the Government and has now become a European standard. We took it into the States and it is at that point that the difficulty arises. Can we win with a European standard against the American standard? If we can—and PCTE has now gone into a second generation, where the debate lies not just in Europe but with the States as well—then, fine. The very fact that we are coherent and take a major part in international negotiations is excellent. But, on the other hand, we have to be extremely careful not to invent a standard in Europe which is not going to be accepted in the States. Being blunt about it, which one is going to win in a global game? There are situations—and high definition television is a perfect example—where for purely commercial reasons it suits us to have different standards, to be blunt about it, but that is not usually the situation. Normally what we are trying to do is not just to sell in Europe but to sell in America or Japan as well. That demands international world standards.

722. So in many ways the object of a European Framework Programme on the standards side would be to try and achieve European standards that could bring about a standard between Europe and America?

A. Absolutely so. First, I think you can argue in the open systems field that now the running is coming from America. But it was Europe that triggered that motion, and a very important process that has been. We are much better in Europe when we stand together on standards matters. There is no doubt that the Americans in particular have now had to recognise that there is something coming from Europe that they really have to take notice of—a very important development.

723. Are we all going to get 240 volts? One complaint that has surfaced in some of the evidence we have had is that when it comes to European Commission approval of collaborative projects in this field—the information technology field—the decision appears to rest too largely with academics who are not familiar enough with what the eventual commercial outlets are likely to be. Do you think that is a valid criticism?

A. I have to say that there have been occasions when I have gone into battle on just that ticket in Brussels. I think in general the balance is now right. We went through a stage where the academic world found itself, somewhat to its surprise perhaps, playing in the industrial field. At that time I think there was an element of adopting the purely academic approach without realising that there was an exploitability dimension. On the whole now—and of course with the programmes of these magnitudes there are always individual problems—I think the balance is pretty good, partly because

our academics have, as you might expect, learned very fast how to listen to the industrialists and, if you like, to lead the industrialists where that is desirable, partly I think because the Commission has learned to play the game. In the information technology area there has been a very interesting development in the last few years of what is known as the Basic research programme within ESPRIT. There is now a section—up to 10 percent of the programme—which is purely aimed at the longer term work. It is not entirely academics, but some of the projects are entirely academic. That has been an extremely healthy development in my view. It has made the academic community in Europe cohere in this applied area in a way which was not true before. It was clearly true in high energy physics. For most of my career British academics have looked more towards America than they have to Europe—that has certainly been true in information technology. That has really changed very rapidly and the whole ESPRIT programme, the basic research part in particular, has shifted that balance. I personally think that is excellent. If you look at the quality of some of the academics getting together in, for example, the logic language area, where one sees Tony Hoare from Oxford working with Alan Colmerauer from Marseilles with a team at Munich run by what were the three big firms, ICL, Bull and Siemens, that is an extremely healthy development. There, of course, the policy must be set almost entirely by the academics—I hope not entirely but very largely because industry will not have the vision to look that far ahead. As it happens, that programme has been extremely well run in my view and I think in the view of most academics. The problem is that the competition is intense; something like one in eight projects gets through and I think that is far too low to be able to run a successful peer reviewed programme over time.

724. Would you say programmes like ESPRIT and EUREKA and RACE have, as it were, served their purpose by providing launch aid for collaboration of this sort and now people have got into it perhaps we do not need such bureaucratic organisations in future?

A. I certainly think it is time that the emphasis in ESPRIT shifted. In the RACE programme in a sense the users have always been there because the PTTs of Europe have been collaborating in that programme and there was a rather direct industrial, an explicit industrial, target, if you like. In the ESPRIT programme there have always been industrial targets for the sub-plots; but essentially it has been a technology led programme. To my way of thinking, the time has now come when the users should be put in the driving seat of these programmes, with much more user participation in the whole selection process, in the planning process, in the individual projects, in the peer review committees and so on—perhaps because we have learned now how to collaborate and we can move on. The EUREKA programme has been, I think a less successful

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programme than the Commission programmes because of the lack of coherence. They are, after all, individual firm-led programmes and you can literally get projects in a limited area where the firms are attacking each other in a way which to my mind is simply carving up the market, they go non-critical, and the Japanese move in.

There is nothing in the EUREKA mechanism to defend that sort of thing. On the other hand, the great advantage of the EUREKA programme is that it is very much more market-led, of course. It is closer to the market than ESPRIT for more fundamental reasons. I would like to see a merging of the objectives of EUREKA and ESPRIT, moving ESPRIT nearer to the markets certainly but removing areas like the basic research programme, giving ESPRIT a stronger strategy sense than it has had. I cannot comment on RACE but I believe that in a sense RACE has already had the best of those two worlds. In a sense RACE has been a cross between EUREKA and ESPRIT.

725. Would you like to hazard any sort of comment on the respective achievements of Alvey and ESPRIT?

A. I think there is clear evidence that more has been exploited out of ESPRIT than out of Alvey, if by that one looks at product on the market. If I have to face why that is, I think one has to come back to this problem of capital. You probably know of the study by the Federal Reserve Bank in the United States looking at the cost of capital for R&D in the various continents. The figures work out, after allowing for taxation and other things like the equity ratio, that in Japan the cost of capital is now 8.5 per cent., so that is, of course, much lower than here; in the States and in Europe as a whole it is 18.5 per cent. and there is a wide spread within Europe, and within the United Kingdom it is 25 per cent. I believe that that is a simplistic explanation—too black and white, of course, but at the heart of why so little of the products came out of Alvey. On the other hand, I do think that the most important product of all these programmes has actually been the people. They train, in really large numbers, people who go on to be the mainstay of the industrial world. After all, in a very short period of time, ten or twenty years, those thousands of people, literally thousands, who are collaborating across Europe in these programmes will find themselves in the driving seat in industry. They have built up relationships across Europe which will not die. We all know that from our own experience when we were at a similar age, often collaborating with the States. That will totally transform the European scene, not just the industrial scene. In the long run I think that will be the most important outcome. In my own firm it is always nice when we find recruits, as we do very frequently now, who cut their teeth on the Alvey projects. They come in with an understanding of the industrial world. They come in understanding the technology which previously was not there. I think both programmes can claim that the European world has woken up to

certain technologies which previously we were ignoring; to take an example, the human computer interface and the emphasis on human factors in information technology, an enormously important step forward, and I think it was very much accelerated by these programmes. Formal methods is a very good example where the work was entirely done in the academic world, before these programmes came along, providing collaboration with industry, and I think I can claim in the United Kingdom, first of all, but now in Europe we are leading the world in that area. Formal methods are crucial to safety critical systems and, as I said, you can see that is going to be enormously important both for society concerned about the safety of aircraft and nuclear reactors and transport systems and so on, and for the firms concerned.

726. If you wanted to see improvements in this field generally where would you seek them?

A. I think I would get the Commission and the bodies that advise the Commission—very often that means the Big 12, as they are called, in Europe and there is now a move to form a similar body of the major software houses and so on—to face up to moving the centre of gravity of the programmes nearer to the users, giving the users very much greater involvement, building up the basic research programme. I am glad to say that the ESPRIT Advisory Board's, the top-level board of ESPRIT, concept of doubling the basic research programme at the expense of the rest of the programme went through unopposed. We all see the benefit of that.

727. Would you like to see DTI take a more proactive role?

A. Yes. I have to say I think that is enormously important, though having said that, can I say that research is simply not enough. We are all after a successful industry from these programmes. To simply fund and look after the research side is inevitably, in the situation we face, going to lead to disaster. It is a necessary condition to have good research. If we do not have good research then we can never succeed. But it is not a sufficient condition and to be concerned about the health of industry, particularly, in my view, this point about the cost of capital to industry as a whole, but other things like training, trying to cohere industry into a strategy, that I believe is the crucial role for government and I do not think we can continue to duck it.

728. And the problem is the borderline between near-market and not near-market?

A. That is where the conflict comes up, the simplistic view that to look after research work which is away from the market is enough, though I think it is fair to say my academic colleagues will say that even that has not been satisfactorily looked after in recent years. We will, in my view, come to regret that in time. That is part of the problem but we must put the whole focus on the whole of

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industrial success, training as well as R&D, exploitation, capital, all the things which lead to industrial health, not just picking on the one, even if that one is key.

Lord Porter of Luddenham

729. You have a number of times in a number of different words drawn attention to the importance of putting the users in the driving seat. I quite understand that and one sees where international collaboration between the users can be valuable. I am not quite so clear as to what your message is on the other side because you said what we all like to see from time to time—we the academics anyway—is scientists doing collaboration perfectly well on their own. You mentioned the Napoleonic Wars and so forth and it is true. I am sure I agree entirely. But having said that, you then talked about in addition putting users in the driving seat and—this is the most important thing—that we must double the basic research programmes. I do not quite see what your message is here. Is that really necessary? If the basic research people collaborate and always have done successfully, do we need any top-down *dirigiste* programme on the basic research?

A. I would not use the word *dirigiste* myself. I think it is very important that the leadership comes from industry. Maybe that is *dirigisme*. It is all a question of what part of the spectrum we are looking at.

730. The leadership for the basic research comes from industry, you said?

A. No. Most of the programmes we have spoken about are programmes for industrial health and I suppose the basic research programme is that, too. But where the motivation relates to products that you can see coming to the market, where the objective is something for the market now, then in my view a combination of the users and the manufacturing industry must be in the driving seat. At the basic research end I think that would be quite wrong. What I would like to see is a situation where industry and the users are watching what is going on in these areas. I am not talking really about a pure research area. We call it basic but, of course, it is basic within a spectrum that is really technology, if you like, or at the very least applied science.

731. So when you talked about a basic research programme, you did not mean basic really?

A. It is what we call basic but frankly it is basic applied.

732. Longer-term applied?

A. Longer-term applied. An example would be in microelectronics. We are moving to the point where we can no longer use light; we are now using ultra violet and we now have to face using electron beams, X-rays and so on.

Now, it is the basic scientists, the pure scientists, who understand those areas; they have now got to

help the technologist in industry to evolve the machinery, the instruments, for using that in what will become industrial work. We call that basic in the sense that, for example, the development of eczema lasers and that sort of project is seen as a research function, a university function in the first place; but the goal is one which is set out in broad terms by industry who can see not how to achieve it but what they eventually are going to need.

Lord Flowers

733. Is that not what Lord Dainton would call strategic?

A. I think that is right.

Lord Dainton

734. Just a general point: our remit goes beyond information technology and as Dr Oakley has been speaking I have been getting the feeling—perhaps he would give me his views as to whether this is correct—that in a sense information technology is rather special in the whole range of things we are considering and the fact that I have been turning over in my mind as possibly responsible for that unique quality is that the transition from the basic research in the old sense to actual use is very, very rapid, very short-term, is that correct?

A. Yes, I believe that that is one of the distinguishing features of the whole Information and Communication Technologies scene, that the whole cycle has now got speeded up to the point where one has to be extremely rapid in pulling the ideas through from the academic world into the marketplace. After all, some things that are coming to the marketplace now will be obsolete in three years' time in information technology, which is quite different from the pharmaceutical industry. No doubt in pharmaceuticals you need the same science backing to what you are doing, but when a firm finally gets to the market with it then it can expect a life of twenty years or something like that. I think it is that speed factor which accounts partly for the emphasis that we have had to put on the IT collaboration. There is one other factor: like so many other industries we are moving through that stage of forming into larger and larger firms. It happened in the chemical world at the turn of the century, it happened in the oil world and in the aircraft world and the vehicle world. Now it is the IT industry's turn. That, I think, is one of the reasons why it is such a sensitive area.

Lord Nelson of Stafford

735. Is there a need for international compatibility too?

A. In anything to do with communications you must have standards and in information technology communications lie at the heart of it, yes.

*6 December 1990]*DR D M LEAKEY, DR J E THOMPSON,
MR P STRICKLAND and MR K GYMER*[Continued]**Lord Dainton*

736. Could I follow that question up with one other point? Because it is so rapid, is it difficult for a new activity to get to the market on the back of some new idea? Does it mean, as you were saying, because of amalgamations, it is only the big boys who are already there who are able to take advantage of these new developments quickly?

A. I am highly suspicious of the likelihood of the success of the small high technology firm in this area. I think that the pattern is pretty clear, that if one starts with a small firm—and very often one has to in order to persuade the big boys to take notice—the time when that will really be successful on the world scene, at least in the European environment, is when that firm gets taken over by a big firm with the capital to enable it to tackle the world market, yes.

737. It seems to me in those circumstances we do need, as Pasteur said, to favour the prepared mind. We have to be very careful about preparing people in the universities in this particular field for a life of this kind which strikes me as quite different, as you have said, from activities in other fields in industry.

A. I agree with that completely. It seems to me high time that we faced up to the fact that we are no longer training and educating people for life at the end of their first degree. The process of re-education in this field is vital. I find it within my own firm where, young as we are—I am the oldest man in the firm by far—there is a need for re-education of those people who were brought up before, for example, formal methods. They now need a background in logical mathematics which was not seen as necessary

ten years ago. That is very important. Interestingly, of course, the young people coming out of the universities are driving the firm from the bottom. It requires a very interesting management style to cope with that.

Chairman

738. Could you make any comparison between French, British and German universities in their attitudes and success in taking part in these sort of collaborative programmes?

A. On the whole I think the British universities have seized the opportunities remarkably well. Maybe the devil drove them. Maybe the fact of the hard times here in Britain has caused them to look to wherever the funds are, but there is little doubt in my mind that they did work it out earlier and woke up earlier than some of their colleagues. The German universities have been noticeable by their absence through quite a lot of the programmes, I suspect because their funding was such that they could afford to remain insular. In the usual way, the best scientists get together to collaborate and that appears in the programmes. That is never a problem. I think there is more of a problem with those who are vital in the areas where there is a great deal of work to be done, but perhaps not quite so much inspiration; then maybe each country in turn has had to learn to do it. I suspect the United Kingdom has a lot to teach the others in the academic world.

Chairman] Thank you very much indeed, Mr Oakley. It has been very helpful and we are very grateful to you.

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[Continued

Memorandum by British Telecom

Thank you for your letter of the 8 June 1990 addressed to Mr Vallance.

This interim reply has been prepared to indicate the nature of British Telecom's interest and involvement in international scientific and engineering programmes in order that the sub committee might judge whether it is of interest. If the sub committee would like more information British Telecom would be pleased to provide it.

Given that British Telecom must operate as a commercial company providing telecommunication services in an increasingly international environment, its primary interests are:

- (a) International (and European) collaboration to establish those architectures and standards necessary to promote the provision of international telecommunications services.
- (b) Those advanced research and development programmes necessary to establish the basis for future advanced telecommunications networks and the associated customer services.

An example of (a) is the establishment of Integrated Service Digital Networks (ISDN) standards, the work being carried out in Europe by the European Telecommunication Standards Institute (ETSI). Although the DTI is involved, the BSI plays only a peripheral role with large UK interests being represented directly on ETSI.

An example of (b) is the European RACE project aimed at providing the technological and services foundation for the introduction of compatible Broadband services across Europe.

In the case of European collaborative ventures, the European Commission partly funds the work and takes a considerable interest in the output. This is not only to promote European industry and European-wide communications, but much of the work also forms the foundation on which European regulatory standards can be developed to provide the basis for regulatory control of the service providers.

To promote the joint development of advanced systems, but at the same time to avoid conflict with European competition directives, the concept of "pre-competitive research" has been developed. Unfortunately this concept leads to considerable practical difficulties in that without a degree of commercial input an essential ingredient of any realistic industrial research is lacking. In addition a primary motivation of all industrial research is to generate intellectual property rights (IPRs) which ensure that a suitable return is obtained from the expenditure involved. The ways by which IPRs arising from "pre-competitive research" can be controlled, distributed and onwards licenced are far from clear. This remains a serious impediment to adequate collaboration particularly where considerable funding from national or European institutions is involved.

With respect to your specific questions, summary answers are as follows:

- (i) ISPs are particularly advantageous where the challenges are also international in nature as, for example, with global communications. The primary difficulty is establishing an adequate commercial basis for the collaboration particularly that associated with IPRs.
- (ii) Hosting large facilities is not a feature of the telecommunications scene. However, there is an equivalent expense in setting up trial networks which, to achieve their full benefit, must form the starting point of the actual service networks. Such networks have to extent over many countries and represent a considerable financial outlay before customer acceptance is fully established.
- (iii) It is British Telecom's perception that the best international programmes are those with a well defined commercial objective, where the co-operating partners subscribe jointly to this objective in a constructive and collaborative manner.
- (iv) The criteria for such programmes are technical and financial, but most importantly they also relate to the service potential that could result from the work. To provide improved justification for the programmes, they are normally preceded by a feasibility stage in order that the major parameters of the proposed programme can be established with adequate certainty.
- (v) Particularly in Europe, the forums are normally hosted and lead by the Commission or its agents. Network operators, service providers and equipment manufacturers (software and hardware) apply to participate usually on a 50:50 funding basis. Other projects are left to industry to operate.
- (vi-ix) Collaborative work on a national basis appears to be gradually reducing in significance. The telecommunication industry is rapidly becoming more international in nature. The involvement of particular local problems or, to encourage local industry. In achieving such goals onerous national rules can be counter-productive.

If the sub-committee would like additional information on any aspects please let me know. More detail can be provided if the sub-committee feels it would be of assistance, on collaboration in telecommunication research and development on a national, European and fully international basis, both *via* recognised bodies and *via, ad hoc* groupings of like-minded international companies. The latter is becoming increasingly

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[Continued

significant to avoid bureaucracy and to reduce timescales. In particular British Telecom have considerable experience of European initiatives such as RACE and ESPRIT. If the sub-committee feels that this could best be communicated by means of presentations and discussions, I would be pleased to make arrangements.

I hope these comments will be of interest.

Yours sincerely,
Peter Strickland

Examination of Witnesses

DR D M LEAKEY, Chief Scientist, DR J E THOMPSON, Chief Engineering Adviser (Corporate Research Programme), MR P STRICKLAND, Government Relations Department, and MR K GYMER, Intellectual Property Unit, British Telecom, called in and examined.

Chairman

739. Dr Leakey, I would like to thank you and your colleagues very much for coming and giving evidence to us this afternoon. Thank you very much for your written paper also. If you would like to make any introductory statement in amplification of your paper we would be delighted to hear that.

(Dr Leakey) My Lord Chairman, as an opening statement can I say that you mentioned that the outlook of Mr Oakley might have been somewhat narrow. Ours is even narrower. We are in the telecommunications part of information technology, and we are in a particular part of it. I think this has to be pointed out. You can divide communications into seven levels. At one level there is the basic science and the associated materials. We then have the components that go towards making our systems, semi-conductors being an obvious example. Then you have telecommunications sub-systems like telephone exchanges, optical fibre systems, radio systems, which are the basis of our business. However, we (strictly) are not involved in any of these lower levels. We are involved in the next levels which include managing telecommunications networks, and managing the basic services that go on top of networks. At the moment these services are regulated in this country and subject to a certain amount of discussion. We are also involved in the so-called value-added services that go on top of these basic network and services levels—in American parlance, enhanced service providers, ESPs. In general these services are fully competitive around the world. Example include messaging services, electronic mail and so on. Then finally, since telecommunications alone does not constitute a complete service there is the complete application level, which often also involves computers, storage media and so on. We are interested in the network and the services and not directly interested in the lower levels normally associated with conventional science, although I hope there is some science in the levels we are involved in. You can do so-called basic research in all the levels, although it is not customary to associate basic research with the higher levels we are interested in.

The second comment I would like to make is that we must be quite commercial in our attitude towards research particularly whether it benefits the country and the company. Quite bluntly, gone are the days when we as a country can be simply nice to the rest

of the world. We are in a very competitive situation and one should judge research is a commercial investment which should show a return in some tangible form to those who are investing their money. We must have a fairly hard commercial outlook on the subject, an outlook which some of you might not completely share.

740. Would you like to make general comments about the European collaborative programmes with whom you are associated? I do not know whether you heard Mr Oakley put forward the idea that the European Framework Programme should be looking in the standards field wider than just European standards, and research in those programmes should take that wider view? Would you like to comment on that?

(Dr Leakey) My Lord Chairman, the main programme we are involved with is RACE because of its obvious telecommunications focus. I think our concern about RACE is that it is too technology-driven and not enough market-pulled. The first thing to note in today's telecommunications business is that the speed at which one gets from reasonably basic research to actual applications is quite fast. The concept that you can do technological research followed by demonstrators and then wait after several years to see whether the demonstrators are successful just does not line up with the reality of the situation. The second associated point is that one is in competition often with small American companies who seem to have the knack of better matching technology push and market pull and getting to the market quickly. The American market also appears easier to penetrate rapidly than the European market. We seem to put more impediments in the way of entrepreneurs getting to the markets with new products. The resulting impression is that RACE is producing some very good technology and one would not comment adversely in that sense at all, but it could be overshadowed by more tactical advances that are going on faster behind the scenes and which could so shape the market that when the RACE Technology is ready for real commercial exploitation, the market's need is already met by technological poorer but nevertheless more timely adequate alternatives.

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DR D M LEAKEY, DR J E THOMPSON,
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[Continued

Lord Dainton

741. I do not understand this. I wonder if you could illustrate it in some way. This is in generalities.

(*Dr Leakey*) A very good example is the case of wide-band managed networks. There are various small American companies, of which names like Newbridge, Stratacom and NET come to mind, who are actually installing systems which are not necessarily perfect wide-band systems but nevertheless are having quite widespread application. The customers who take these networks tend to be very big companies and are not readily going to change to technically superior integrated solutions in the future if it is at variance with the equipment they already have in service. That is not to say one is against long term technical strategies but the way there is often a very stony road with companies putting interim equipment on the market, being commercially successful with this equipment and thereby determining the future by virtue of the installed base. You cannot replace everything overnight with the latest technology.

Lord Adrian

742. Could I ask whether BT does have work going on in that field in their own research enterprise?

(*Dr Leakey*) To give you the detail I will pass you over to Dr Thompson.

743. Yes or no? Were you working on that?

(*Dr Leakey*) The basic answer is we are heavily involved with the RACE programme. We are also installing systems from smaller companies because our customers demand systems like these at the present time.

744. I was wondering whether it is being developed and I am speaking now out of profound ignorance. The development of wide-band managed networks was obviously something you were impressed by in some sense. I wonder if BT itself had been working on those matters. Was it an area that BT had judged to be of interest for research?

(*Dr Leakey*) The answer is in principle we have known for a long time it is a very important area. Our main interest is to become knowledgeable about the subject so that we know which equipment to purchase to make the type of networks which meet our customers' service requirements.

Lord Dainton

745. Are you saying in effect that what is compatible with what you at present have and is close to what the customer ultimately demands might drive out or deter the technologically excellent?

(*Dr Leakey*) Absolutely. The investment in telecommunications is enormous and we cannot suddenly change the equipment. A very good

example is that we have an enormous amount of copper, in the form of twisted pair supplying you with a telephone service, and although we would like to supply everyone with optical fibre—and Dr Thompson can go into great detail on that—the hard fact of the matter is that it is a very expensive change.

746. So who is it going to benefit? Assuming that RACE produces something which is technologically good, who will that benefit?

(*Dr Leakey*) I think the answer involves how you apply RACE technology and this is again a subject that I think Mr Oakley raised. It is necessary to take account of three factors simultaneously when you do research which is not pure in nature. First, obviously you have to take into account the technical advances that are possible; secondly, you have to take into account the likely market situation when you are going to realise that equipment because you are not going to be able to change the world overnight. This goes hand in hand, of course, with customer requirements. Thirdly, one has to take account of the regulatory situation because this can have a very big influence on telecommunications, not only in this country where it is a topical subject but, in every country where one wishes to provide a service.

747. So if there were no RACE programme with Government money in Europe behind it would the existing firms ever do it?

(*Dr Leakey*) I think the answer is yes, if they wanted to stay in business, but they would probably do it with a very much bigger bias towards the commercial need, the user requirements and the regulatory requirements than is probably happening in RACE. I have to say that the people in charge of RACE are well aware of this challenge and as such the comment is not directed at them. I think a lot of the problems started when the concept of pre-competitive research was introduced.

748. So this means you do not feel at the present time, and other big enterprises like yourselves do not feel at the present time, you really want to have more influence on the policy and arrangements for a programme like RACE?

(*Dr Leakey*) A lot of us would probably wish to modify the programme so that it had far more commercial input. An arrangement to increase the rate which technology could be introduced into the marketplace would be welcomed.

749. A moment ago you said you were quite content that the scientists were aware of this?

(*Dr Leakey*) Many people in Europe are well aware of this and are trying to modify the system. As you well know, it is not necessarily easy to change a system.

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DR D M LEAKEY, DR J E THOMPSON,
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[Continued

Lord Porter of Luddenham

750. What can RACE do for you that you cannot do for yourselves? BT is a big company. You know your opposite numbers in the other countries. One thing it can do for you is in taxpayers' subsidy. I can see that for research but let us leave that out.

What do these government or EEC or from-the-top-organised programmes do for a company? I can see for small companies they may do something. For companies as big as you what do they do that you cannot do yourself? You would obviously change it anyway.

(*Dr Leakey*) I think the first important point is that BT is not a big company in relation to the amount of research, development and launch money one has to put into these large developments. Certainly BT's market is not big enough to justify unique solutions for BT. This started to be true probably some twenty years ago. Before that time we had our own telecommunications equipment, although it had to obey certain international standards, otherwise it would not have worked internationally. We had equipment supplied from several British companies and we worked together in a collaborative manner. This is no longer the case. The cost of these large developments is now quite enormous—a thousand million pounds is often quoted. To obtain a reasonable return on a thousand million pounds requires a market base somewhat larger than that offered by BT alone.

751. So I understand. This co-operation is therefore essential and beneficial and everything else. My question is, you know your opposite numbers, why can you not do it yourselves?

(*Dr Leakey*) The answer is we do. But the next question is, with whom? One tends to collaborate with others where one can have a reasonable commercial understanding—it might not be an agreement but at least it is an understanding. It is difficult to collaborate in development if one is then going to compete at the realisation stage and afterwards. We collaborate with companies where we at least have a commercial understanding, often on a supplier-customer basis. We do not necessarily do joint development.

Chairman

752. You are talking about collaboration with suppliers of equipment to you?

(*Dr Leakey*) We collaborate with the suppliers both in this country and abroad because, as you know, we buy a percentage of our equipment—still quite a small percentage—from abroad. We also collaborate with certain of the American operators because, whereas our major suppliers provide the basic network elements, we ourselves design the network and the service management elements. This is also the case with other operators, so there is some collaboration at the network operator level.

753. When we were studying the space programme and took evidence from you about satellite communications the point was made to us by your representative that this was complicated by the fact that the Bundespost and PTT were, as it were, national organisations who thought much more in terms of what they wanted for themselves than what the actual consumer wanted in Europe. Is that something which affects you seriously?

(*Dr Leakey*) It affects us seriously in the sense that we appear to find it rather more easy to collaborate with our colleagues in the United States than we do with our associates in Europe. We also have to take the challenge that part of the time we want to collaborate with the Bundespost Telekom and France Telecom, but in parallel we wish to provide our value added services over their networks and compete with them.

(*Mr Strickland*) I think, in fact, Chairman, a further point can be made there, which is that if British Telecom wished to collaborate with organisations such as the Bundespost and France Telecom, we would now have to look at the legal side of it extremely carefully because the European Commission, in trying to promote competition between telecommunications operators in Europe, is tending to look with increased suspicion at all kinds of collaboration between them. It means that, if you are going to enter into collaboration on matters such as standards or service offerings with organisations such as that, it will nowadays almost certainly involve a formal notification to the Commission and discussions to make sure that one is not infringing European competition law and acting against the interests of consumers. So there are some practical obstacles towards further co-operation with other European telecommunications operators.

Lord Nelson of Stafford

754. Can I pick up a point Dr Leakey made earlier on being hard-faced about research expenditure? I can quite understand that. But on the other hand there are one or two pieces of research which have completely altered the communications scene. There is the semi-conductor invented by AT&T. You referred to optical fibres. We might refer to space and the satellite communications system. I would have thought, bearing in mind the size of the moneys involved, the size of the systems involved, there was quite a strong case for international research collaboration to make sure that somebody does not come up with one of these major changes which is going to make your investment obsolete. That might well be done on an international collaborative basis.

(*Dr Leakey*) I think that is absolutely correct, but there are two points to be made. Optical fibres were invented by ITT STC. They do not appear to be the company which has benefitted most from the invention. It is quite interesting to note how many of the companies who produce these initial inventions are not the ones that benefit the most. Many

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DR D M LEAKEY, DR J E THOMPSON,
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[Continued

[Lord Nelson of Stafford *Contd*]

companies have benefitted more, I would suggest, than ATT who invented the transistor. A lot of these basic research activities, I agree, are vital to the would, but they seem to become generally available to everybody very quickly. As Lord Nelson knows, my upbringing is in the company he was associated with, which was GEC, and quite bluntly one has learned to be quite hard-nosed about these things. What is the likelihood of a return on what you do for the company itself? One is not against advanced research. In fact, Dr Thompson here can tell you about the way we have set up an advanced research unit within British Telecom. But I think one has to take a very hard commercial view of such attitudes.

755. You are not afraid that the Japanese will come up with something?

(*Dr Leakey*) I think the Japanese are an excellent example. The number of basic inventions they have produced is relatively small. However, they have done well in making use of the inventions the world has produced. I am not so sure that happy with this situation, but it appears to be reality.

Lord Porter of Luddenham

765. You seem to be saying that collaboration, international or otherwise, is only of benefit to the second class: if you are good and you are at the top, keep it to yourself—is that what you are saying?

(*Dr Leakey*) One can never and must never make the assumption that *kone* is at the top, so one does collaborate. What I am suggesting is that one collaborates for good commercial reasons, not for pure esoteric reasons.

Chairman

757. You say in your paper that *ad hoc* international groupings of like-minded international companies are becoming increasingly significant to avoid bureaucracy and to reduce timescales. Do you think that the day of RACE and ESPRIT and, as it were, rather bureaucratically led programmes like that is on the way out and the future does lie in *ad hoc* international groupings of like-minded parties?

(*Dr Leakey*) We made that comment specifically about standards. It is interesting to note that although we have international standards organisations like ISO and CCITT, if you look at the standards that we use in computing in particular, many were produced by companies or by groupings of like-minded interested parties. A good example is UNIX, the famous computer operating system, which was not produced by an quasi international body but by a single company and then adopted by international bodies. If one takes the case of the interfaces which are going to be used between the human operator and the personal computer, the new interfaces are being produced not by official international bodies but by groupings of like-minded companies. Equally, network management standards have been produced in a similar manner.

Lord Sherfield

758. Are you saying that these systems are compatible with the international standards or that they have become compatible because the international standards organisations adopted them?

(*Dr Leakey*) It tends to be the latter. One of the great difficulties with international bodies is getting decisions to adequate timescales because everybody has to vote in a democratic manner. There are strong commercial pressures to have standards particularly in order that the various pieces of equipment can work together, and this increases the market size and the customers. The primary motivation to get together to produce standards should be commercial, not a purist reason that the world wants standards.

Chairman

759. I find that very interesting because in your paper it did not appear to apply particularly to standards because it is exactly the opposite of what one might have thought. Certainly various people have said to us that the European Framework Programme ought to concentrate, because its subsidiarity is something that European organisations could do better than a national one, on producing standards rather more than anything else and yet what you are saying is the best way of having a standard is for perhaps the principal people in the field to set a standard and then get other people to adopt it?

(*Dr Leakey*) I think that is absolutely right. The best Europe can do is produce these standards, but they have to produce them to commercial timescales. It is no good having a perfect standard five years later than it is wanted. This is something we are very keen to influence. We do not only want European standards; we want them to become international standards because there is very little point having just European standards. There is no reason why Europe should not lead the standards activity but we do want the standards to timescales that are commensurate with our requirements and our customers' requirements.

760. So how do you set about influencing the Commission in setting standards?

(*Dr Leakey*) One of the ways BT and other telecommunications operators have had an influence was setting up what is called ETSI for telecommunications standards, which I think has done reasonably well in avoiding much of the bureaucracy, that tends to exist in some other more formal standard-making activities.

761. Is this going to extend to Central and Eastern Europe and even the Soviet Union?

(*Dr Leakey*) One hopes so, but there remains the need to get the standards to the right timescales. This is always a big dilemma, how do you get everybody involved, while still achieving results to the timescale required by the market.

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[Continued

[Chairman Contd]

762. You reckon ESPRIT and Alvey have both been helpful to you?

(Dr Leakey) Alvey has been helpful but not necessarily in the telecommunications field because its main areas of activity were in IT, computing and semiconductors. Again, as you are aware, RACE is the main activity in Europe devoted to telecommunications.

763. And ESPRIT? Has that affected you much?

(Dr Thompson) Yes, we have had a number of involvements in ESPRIT projects, ESPRIT 1, for example. I remember the statistic we had was about 14 ESPRIT 1 projects, which cost us something in the region of £3.5 million total investment and that gave us access to about £48 million-worth of work, when you calculate the other participants and indeed their dependent universities and so on. That was an area of work that covered silicon design, prototyping, field trials of communications services, software engineering and so on, which by virtue of that leverage we believe must have shown us some benefit. 14:1 is such a massive factor we feel we must have won out there somewhere, but looking back it is rather difficult to find exactly where in BT's particular area of interest. I think the only project we can see that has come to fruition now is in the area of European audiographic conference systems which will actually be demonstrated to the European Commission, and that has been seized upon as an effective demonstration within the dispersed buildings of the European Parliament. It will mature next year. It is a good example but one of only 14 projects in which we were involved.

764. In international collaboration in your field you have described all sorts of things you would see yourselves doing. What sort of things would you see the university-led research doing? What sort of things would you see your suppliers doing and do you get any help at all from government research departments like Malvern?

(Dr Leakey) I think I am personally not too certain how universities now approach research. We certainly would not do research in basic physics and that may obviously be something universities should do. But universities are beginning now to grow their interdisciplinary research and that in many ways could be of more direct importance to us because of our interest in network services and added value services. This is maybe quite a change from more traditional university research, although I am not inferring that they do not do it now. For example, the management department could well collaborate with the engineering department to produce communication systems that are optimised for modern management use. This would be of great interest to in the development of new services and systems.

765. But you do not yourselves have any research contracts with universities in that field?

(Dr Leakey) The answer is probably not in that field but in other fields we have a significant investment.

(Dr Thompson) Yes. We have quite significant investment in universities in the long-range understanding of optical physics, for example. Indeed, that is the best place for it. We do a lot of work within our own research laboratories to understand the limits to which you can push optical transmission and eventually optical switching and so on but the application of that is typically 15 years away.

766. And they could be involved with you in a collaborative project in that field?

(Dr Thompson) They are indeed. We do have a LINK project in which a couple of universities and ourselves are involved to look at that very area.

767. How about your suppliers? Where is the dividing line between the research you do yourselves and the research you expect them to do?

(Dr Leakey) First of all, there is a fair amount of overlap but, on the other hand, the separate requirements need to be fairly well defined. You may know we have a demonstration at Bishops Cleeve of potential optical fibre distribution systems for domestic households and small businesses. That is an example where we jointly did considerable research and development but at the manufacturing stage it was our suppliers who made the equipment and solved the detailed difficulties. We shared the installation as appropriate. BT now operates the system. It is a good example of close collaboration but the split of responsibilities is quite well defined. Another example is what is called intelligent networks where useful and interesting service facilities can be provided by centralised computers controlling the whole network. Our responsibility is deciding what services are required and what interfaces should be between the various types of equipment. The suppliers make the equipment and provide software to meet these specifications and network requirements.

Lord Sherfield

768. To go back for a moment, are you involved in the LINK programme?

(Dr Thompson) Yes, only two, though. One of them, as I said, is to do with long-term optical network design. The other is a very important one to do with the personal communications technology. The personal communications programme began as a very ambitious attempt in the United Kingdom to capitalise on the commercial success we had in cellular communications. We had already had two established cellular networks and we could see the European and the world opportunity to develop that advantage into future systems of mobile technology. The LINK programme was set up following an SERC initiative with some of the universities, to carry the work through into technology transfer and

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[Continued

[Lord Sheffield *Contd*]

to get a number of industries involved. It was a very ambitious programme. I forget the exact detail but it set off with more funding than it has so far been able to commit. It has been very late getting projects to start because of intellectual property problems.

British Telecom is involved in two of the four projects running.

769. Are you satisfied with the way it goes and the results?

(*Dr Thompson*) I am becoming satisfied. I think we have lost a number of years in argument over intellectual property conditions because eventually we found most of the other industrial participants in this programme became our competitors. The programme was conceived about four years ago and set up about three years ago. Then licences for Personal Communication Networks were advertised and allocated so we found some collaborators we had already established in these projects were now licensed to be our competitors. So we had to disentangle ourselves and re-form new sets of collaborators. But I think the principle was wrong from the outset. The programme was addressing competitive research in the short-term. Indeed, I understand the DTI gained expertise from this approach how to move in Europe. They drove LINK as a collaborative exercise in competitive R&D creating considerable intellectual property problems and consequently difficulty getting projects started. Now I believe they agree, having initiated a number of competing players in the United Kingdom, that they should adopt a rather longer timescale, and potentially it is becoming more creative, and people are settling down to be a little less antagonistic towards each other. We have chosen projects, and defined deliverables which are not less than five years into the future. So we are happy to collaborate and share the results of that programme because we have a common interest with our other European operators in understanding what the next generation of mobile telephones will be. I hope it will be a European one.

Chairman

770. The intellectual property rights problem depends on how near market your research is.

(*Dr Thompson*) Yes, it does. Of course, you are very much more concerned to have mastery of the intellectual property if you can see when you can apply it; if it is likely to be many years away you are more relaxed perhaps about the agreements you would strike.

771. You said earlier you had to choose carefully with whom you collaborated, it depends on whether there are going to be these intellectual property rights or not.

(*Dr Thompson*) As long as the work is genuinely precompetitive, you rely on your commercial acumen to develop your opportunity when the market is ready for it—likewise for your competitor.

Lord Porter of Luddenham

772. I am very interested in what Dr Thompson has just said. There really has seemed to be a danger that the whole LINK programme would collapse for this reason that you have been referring to, that there are at least two industrial collaborators and they compete after the same business. But you think that the LINK programme could be, is, and will be, a success providing the answer is that it must be much longer term and not immediately competitive, is that what you are saying?

(*Dr Thompson*) Yes, it gives you the opportunity of disengaging from the collaboration at a point when perhaps it becomes commercially difficult if you find yourself increasingly matched with a competitor, but the benefit of the LINK programme does carry on into the standards arena. The principal reason for being in that LINK programme is that we will know and understand and be able to share in the next generation of mobile communications technology.

773. So the collaboration between several industrial companies is important. It would not be as useful a programme if it were simply a collaboration between one industrial company and university groups?

(*Dr Thompson*) I think in this particular instance, of course, it was a necessary prerequisite of the DTI programme that there had to be another industrial partner, but I think the success of the LINK programmes I am aware of will come about because there are other industries involved and those same industries are actually involved in a parallel standard setting forum. The RACE programme has a mobile communications section to it. To be fair to the RACE programme, it may have started off with a rather technology-driven broad-band optical network concept, but very pragmatically realised that there was currently more commercial interest in mobile, and it switched and put a significant amount of funding into a RACE mobile activity. I think LINK is providing a UK platform on which players can prepare their ground to go on to the European platform, which is RACE, and on into the international worldwide standards platform, which is CCIR. In principle this promises commercial benefit for all those who are able to be in that next generation of technology. It is uncertain, of course, because of the regulatory situation. We may do all this work, then, as for PCNs, come to the point where we are not allowed to have a licence. At least, perhaps, you have to prepare your ground and be optimistic.

(*Dr Leakey*) I do not think the commercial problems are insuperable. It is mainly that you have to face up to them and you cannot just face up to them by saying they do not exist, and there has been a slight tendency to do that.

*6 December 1990]*DR D M LEAKEY, DR J E THOMPSON,
MR P STRICKLAND and MR K GYMER*[Continued]**Chairman*

774. Do you get any spin-off from collaboration in the military field with NATO, the signals research establishment at Malvern?

(Dr Thompson) Not significantly. We have put a small number of R & D contracts with Malvern to benefit from their liquid crystal display expertise, for example. They may even beat the Japanese in some area of micro-miniaturised computer display. But it is not an area we could contribute to and it happens to be one UK area of strength just at the moment, so we have capitalised on that. We have some interest in inter-operability in terms of message transfer where RSRE have done quite a lot of work

internationally, but they are quite small activities for BT. There is also collaboration on pattern recognition which is DTI part-funded; it is relatively small.

775. That is not international collaboration as far as you are concerned?

(Dr Thompson) BT and RSRE may be involved in some ESPIRT projects with gallium arsenide.

776. What I was after is, do you get any benefit from any international collaboration they may do within a NATO framework?

(Dr Thompson) Not that I am aware of.

Chairman] Thank you very much, gentlemen.

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MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Wednesday 19 December 1990

INSTITUT MAX VON LAUE—PAUL LANGEVIN

Professor Peter Day

BRITISH AEROSPACE

Mr J Arnall, Mr R Cole and Dr J Stark

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SELECT COMMITTEE ON SCIENCE

AND TECHNOLOGY

(ON THE COMMITTEE'S 13TH MEETING)

Wednesday 19 December 1991

ROYAL SOCIETY OF MEDICINE

11, BEDFORD SQUARE, LONDON, W1P 0JD

BRITISH AEROSPACE

Mr J. Smith, Director of Research and Development

Witness statement in the form of a letter to the Committee dated 12 December 1991

WEDNESDAY 19 DECEMBER 1990

Present:

Carver, L. (Chairman)	Porter of Luddenham, L
Dainton, L	Sherfield, L
Nelson of Stafford, L	Taylor of Blackburn, L
Nicol, B	

MEMORANDUM BY PROFESSOR PETER DAY, FRS, INSTITUT LAUE-LANGEVIN

1. INTRODUCTION

This note is a response to an invitation from the Clerk of the Select Committee (letter of 8 June 1990) to submit written evidence to the Sub-Committee set up to consider how the UK responds to proposals for international scientific programmes. In particular, I wish to use an example that I am familiar with, that of neutron scattering, to raise some issues concerned with our machinery for forward planning of international facilities, specifically in a European perspective. To set my remarks in context, I begin with some general observations about the special role of central facilities in the condensed matter sciences (solid state physics, chemistry, biology) and the background to the UK involvement in the major facilities for neutron scattering.

2. CENTRAL FACILITIES: TEST CASES FOR INTERNATIONAL COLLABORATION

Some fields of science cannot be addressed without using equipment that is too elaborate or expensive to be made available by any other means than through international collaboration. The first, and still the largest and most visible example is CERN, now providing the world focus for high energy particle physics, though financially and administratively based on a consortium of European countries. Less widely publicised, though in my opinion of equal (and arguably greater) scientific productivity and significance, are the establishments that provide facilities to the communities of condensed matter physics, chemistry and biology. The Institut Max von Laue-Paul Langevin in Grenoble, of which I am at present the Director, is a leading example, together with our neighbour the European Synchrotron Radiation Facility. Not only do such institutions attract very large numbers of users from their member countries and beyond, but these users are drawn from the most diverse fields of science (and, increasingly, engineering). Our experimental halls (and cafeteria!) act as powerful foci, not only of international but also of interdisciplinary contact and collaboration. For example, the team operating one of our small angle scattering instruments (D11), on behalf of external users, consists of French, German and British scientists, and the instrument is used by metallurgists, polymer scientists and molecular biologists. Access to such equipment by academic scientists from member countries is competitive, by written proposal, evaluated by international peer review. A small amount of repayment work is also undertaken for industry.

3. THE EXAMPLE OF NEUTRON SCATTERING

Neutrons, like photons, provide the basis for a wide range of diffraction and spectroscopic techniques spanning many orders of magnitude of time and energy scale compatible with elementary repeat distances in condensed matter. In contrast to the photon, the neutron is a massive particle, capable of transferring momentum to a bulk sample and with an interactive cross-section that, unlike photons, does not vary in a monotonic way with atomic number (or number of electrons in the atom surrounding the nucleus in question). It also carries a magnetic moment. These attributes give rise to a complex amalgam of techniques for studying bulk matter (by which I mean samples of about 1-10mm³), be it chemical, biological or in the realm of solid state physics.

Neutrons (and, increasingly nowadays, photons) come out of very large pieces of equipment, so the means to provide them to the scientific community becomes a matter for international debate. Continuous efforts by the UK agencies charged with funding basic science (DSIR, SRC and now SERC) have led to major involvement in two institutions (ILL and ISIS), each of which (I am delighted to say) is universally recognised as the best of its kind in the world. Our very involvement, however, which came about in quite different ways, has led to problems on a current timescale that also raise the question about the way we plan our involvement in ISCs, that finally I wish to address. Before doing so, let me briefly summarise the history of UK participation in ILL and ISIS.

3.1 UK MEMBERSHIP OF ILL

ILL was founded by intergovernmental agreement between France and Germany in 1967, after much discussion by (principally) the physicists in those countries about the need for a very high flux neutron source. In parallel, though chronologically a little later, the scientific community in the UK, which included chemists and biologists as well as physicists, began to put their case to SRC for a UK source to replace the facilities then being made available to them by SRC through the renting from UKAEA of beam time on the medium flux reactors at Harwell. Finally it was decided that British needs could be met most conveniently and economically by joining the ILL project, so on 1 January 1973 Britain became a third partner, equal with France and Germany. As well as contributing one-third of the annual operating budget, SERC (the British partner, or "Associate") made a back payment of one-third of the construction costs of

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the installation, which by then was almost completed. The intergovernmental agreement was further extended in 1982 for ten years and negotiations are about to begin for a further extension from 1 January 1993. Over the last few years three other countries (Spain, Switzerland and Austria) have signed agreements with ILL as "scientific members", paying only a small fraction of the budget (1.5 per cent each at present), no back payment of capital costs, and taking no part in the management. It is further anticipated that Italy will become a scientific member, most likely at a 5 per cent level.

In sum, Britain joined a project for which it had taken no part in the planning or construction, and whose scientific policy had already been largely set. That is not to say that British accession did not have considerable influence on the evolution, for example, of instrument construction and on the scientific topics that have subsequently been brought to the Institut, especially in chemistry and biology. Nevertheless, there remains a sense in which the time "lost" at the outset will not be recovered, as the initial cohort of staff recruited from the outset pursue their careers and as major contracts for infrastructure replacement or upgrade favour companies involved in the initial construction. Clearly, the lesson to be drawn is that, where ISCs are concerned, one should be there at the outset.

3.2 INTERNATIONALISATION OF ISIS

The case of ISIS is the converse of that of ILL: a purely national facility in conception and execution now making strenuous and encouragingly successful efforts to internationalise itself. ISIS was conceived as a means to use many of the components, installations, buildings and manpower that became available on the closure of the proton synchrotron NIMROD at the Rutherford Laboratory to construct a pulsed "spallation" source of neutrons at a cost far less than it would have been on a "green field" site. In fact, the German government cancelled a proposal already at an advanced state of planning for just such a brand new source, the SNQ.

Steady state reactors and pulsed spallation sources are quite complementary, providing neutron beams with different time and wavelength characteristics. It is therefore desirable that a national scientific community should have access to both. Nevertheless, the British neutron scatterers, though numerous and active, are not such a large community that a national facility devoted only to their needs could possibly be justified. Hence, SERC have taken steps to secure participation by other countries. At present, agreements exist with Italy, France, Germany, the Netherlands and Japan, but all are at a relatively low level and none take the form of an "equity" partnership as at ILL. Some 80 per cent of the ISIS budget still comes from SERC.

4. THE NEED FOR PLANNING

It is fair to say that Britain's existing commitments to neutron scattering facilities, described in the previous section, were arrived at as a result of individual decisions that formed no part of any long-term plan. Analysis of the present position, however, shows how it might form the basis of a planned European development. This section describes a possible evolution of partnerships for ILL and ISIS, and the scientific perspectives of the two Institutes. The following section proposes a mechanism for forward planning.

4.1 PERSPECTIVE FOR SCIENCE

ILL and ISIS are universally acknowledged (especially by our competitors in the USA and Japan) as, respectively, the world's leading steady state reactor source and the world's most intense pulsed source of neutrons. Scientific requirement for both can be expected to grow, but in complementary ways. ILL will concentrate on its areas of greatest strength in provision of thermal and cold beams and techniques based on monochromatic and polarised beams. ISIS should exploit its strength in the use of white epithermal beams. Scientists at ILL are refining plans for a Modernisation Programme of instrument, technique and infrastructure development to take the Institut towards the year 2000. The ISIS source has unused beam line capacity awaiting installation of instruments when finance is available.

Scientific problems needing neutron scattering for their solution will increasingly be found in chemistry and biology, in the structures and dynamics of polymers, colloids, micelles and other novel molecular architectures. Applied science and engineering will also be growth points. Elementary particle physicists will look to well-designed experiments on the properties of the neutron to define parameters that test Grand Unification Theories. Such experiments are much cheaper to mount than those observing collisions between accelerated particles.

4.2 POTENTIAL FOR PARTNERSHIPS

The UK, France and Germany will certainly continue as major shareholders in ILL. If the Italian government organisation funding their nuclear and particle physics became a partner at the same level as the Italian National Research Council, which funds their condensed matter research, Italian participation in ILL could rise to 10 per cent. Given their increasing demands on beam time and suggestions for instrument construction, the Spanish and Swiss research councils might well each increase their share. A proposal from the Australian Prime Minister's Science and Technology Council for a modest partnership in ILL is currently being considered by him. At present no Scandinavian country is associated with ILL, though as a consortium they are at our neighbour the ESRF with whom we shall increasingly form collaborations and joint facilities.

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[Continued]

I am not familiar with the present state of negotiations for future partnerships at ISIS, but many of the same countries are involved as at ILL.

5. MECHANISMS FOR FORWARD PLANNING

From the previous section it seems clear that, willy-nilly, the range of partnerships at ILL and ISIS will grow. Can it be regularised, controlled and even planned, for the benefit of international (mainly, but not exclusively European) science and the most effective deployment of British expertise and resources? To what extent too can the activities of the two establishments be correlated, for example in the construction of new instruments and the selection of the scientific programme? What kind of organisation could take on these tasks?

Last year the EEC Directorate XII, Research and Technology, set up a programme called "Large Facilities" designed to enhance the attractiveness of major facilities, especially for smaller members of the European Community. The programme committee recently set up a sub-committee to examine future European needs for neutron sources and how these could be met. At first sight it might be thought that this would be the ideal vehicle to orchestrate collaboration since it is a government body whose conclusions could not be put on one side by the Directors of the establishments concerned, or the agencies that fund them. However, I believe the EEC is not the most suitable arbiter of scientific policy in this area for two reasons. The first, quite simply, is that several of the countries involved are not members of the EEC (or, in one or two cases, even European). The second is that the EEC is primarily concerned with economic and social issues and is not well placed to give binding advice of scientific policy matters.

A more appropriate body than the EEC DG XII is the European Science Foundation, an organisation supported by national governments not only of the EEC countries. I am encouraged in this suggestion by the crucial role that ESF played in assembling the case that was put to governments for building the European Synchrotron Radiation Facility. It happens too that the retiring Chairman of SERC, Sir William Mitchell, is about to become the Vice-President of ESF. I believe, therefore, that DES should invite ESF:

- (1) To survey the current experimental programmes of the European neutron centres with a view to ensuring that the sources are exploited in the most effective way, and if appropriate to work out mechanisms for the pooling of beam time on comparable instruments at different sources.
- (2) To collate information on the instrument construction and development programmes of the centres, with the aim of giving advice to the national funding agencies to pass on to the Directors of the centres.
- (3) To devise a formula through which each country whose scientists used a facility could be called on to contribute appropriately to its funding.

Items (1) to (3) represent a lot of difficult work but could contribute greatly to the cohesive planning of these widely used facilities.

Examination of Witness

PROFESSOR PETER DAY, FRS, Director, Institut Max von Laue—Paul Langevin, called in and examined.

Chairman

777. Professor Day, thank you for coming and giving evidence to us today. This study was started off as a result of a suggestion to us that all was not well with the arrangements, the government machinery in particular, by which we responded to proposals for international collaboration. That is not the only reason for looking at it, but it was the principal motive for starting out on it. In the course of the evidence we have received it seems to have been largely on the one hand about the problems relating to big installations, which appear to be very largely in the area of physics, astronomy and suchlike, which involve government arrangements; and on the other, of course, it is the very large area of co-operation which does not require quite such complicated financial arrangements or perhaps such complicated bureaucratic arrangements. One of the reasons we are so grateful to you for coming today is not only because you are a chemist, and it was felt that we are lacking in views from chemists, but also because you represent an installation that is,

between the two. We would be very grateful if you would like to make any opening statement of your own about the subject generally, and in particular about what are the problems that arise in the field with which you are specifically concerned at present.

(*Professor Day*) Thank you very much, my Lord Chairman. You are quite right that in respect of international scientific facilities our work really spans the borderline between large science and small science. If you come to the ILL it looks like a very large installation and it costs its partners about £30 million a year as an operating budget. Thus it looks very big, but rather emphatically it is not what I would call big science. It is a lot of small science which happens to go on at the same place. It has to go on in the same place because we have one source of what we use, namely, neutrons, and we are the European facility for neutron scattering.

In order to use neutrons to study an enormous range of problems that I will mention in a moment (in condensed matter as well as in nuclear physics and, indeed, particle physics) we need a source of neutrons which is actually a high flux reactor,

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[Continued

around which are about 30 instruments that are scheduled to outside users. By that I mean that access is obtained through the peer review system: people in universities in the member countries who want to do experiments write a proposal and then twice a year these proposals are vetted by international committees who come to Grenoble. We have nine of these committees covering the whole span of science. They select what they believe to be the most interesting proposals, which are then allotted beam time on one of the instruments. These 30 instruments therefore are running for about 250 days a year, for 24 hours a day. The reactor runs in principle about 260 days, but next year it will run 230 days because we shall be forced to make some economies. That will be not for technical reasons but for financial reasons. During the 230 days data are taken continuously on these 30 instruments. Those who come to do experiments are people from universities, government laboratories, principally in the member countries, Britain, France and Germany. However, we also have some minor partners we call scientific members (Spain, Switzerland and Austria) who pay a very small contribution to the budget. They send us scientists as well, of course. We are also having discussions at present with Italy. We hope to get them as a scientific member or, indeed, if one is particularly optimistic, even as a partner. From all those countries therefore experiments flow in. I think you can gauge the real flux of science that is going on by the fact that the average length of experiment is about four and a half days if you take all 30 instruments. Time on some instruments is given out in periods of maybe two weeks and some, indeed, are only 12 hours. During this time a new team arrive with their samples, possibly also with their equipment, set it up on one of the instruments, do their experiment, take their data and go away with the data which is transmitted by various data transfer methods back to their own laboratories. All this represents a gigantic flux of scientific activity. For example, in 1989 there were 850 scheduled experiments performed. In the same year—so it must have referred to experiments performed in the year before—came over 500 publications in the scientific literature, which is an enormous amount. That, as I said, is small science because it embraces principally condensed matter, as it is called. That means solid state physics and chemistry (solid state chemistry, solid state inorganic chemistry, if you like) organic chemistry, polymer chemistry, micelles, colloids, biology—I was going to say structural biology principally, but nowadays there is an increasing emphasis on dynamics of biological systems. That is not all because about 15 per cent of our activity is nuclear and particle physics, outside the condensed matter area. In the latter field there are a number of experiments which have been very successful on (it is a nasty word, but it is the one written in all our documents) “fundamental” physics. I think “fundamental” begs an awful lot of questions; I do not like it, but that is what it is called. The particle physics of the neutron; the lifetime of the neutron, its electric dipole moment, the neutron oscillation, these are all kinds

of things that are particle physics. In addition there is of the physics fission process, exotic nuclei and so on.

Finally, in applied science we have an increasing amount of beam time that is awarded to industry in respect of proposals that they make which are long range research that they are prepared to see published and in respect of what is normally called repayment work, in short, beam time that we sell. Therefore, almost every field of science is somehow or other represented within our walls as well as six European countries so it is a remarkable amalgam. I believe—and this in fact was said to me by Jack Steinberger from CERN a few months ago) that we as an institution are absolutely unique in the world in that respect. We are not only international; we are completely multidisciplinary. The other international institutions like CERN or EMBL have rather specific functions. We however cover a very wide compass so I have to say that it is a very exciting place.

In my paper I gave the history of the ILL in outline, and how the United Kingdom came to be involved in it. There are people here, I think, who know that history better than I do. There was a project in the United Kingdom to build a high flux reactor and more or less at the same time the French and Germans had a project so the decision was taken for the United Kingdom to join France and Germany. The ILL was founded in 1967 but the United Kingdom joined in 1973. We made back payments to cover our share of the capital costs as well as the continuing full share of running costs so we are full, equal partners with France and Germany. The other neutron scattering installation in which the United Kingdom is involved is, of course, ISIS at the Rutherford laboratory. That is the other side of the coin. That is a national laboratory which has been making strenuous and I think somewhat successful efforts to internationalise itself. In regard to ISIS at the present moment—I do not know the exact figures, I am afraid—I think at least about 80 per cent of the funding is still SERC, but there is quite a large international involvement. ILL was international from the outset. Coming in—and I have been there about two and a half years now—I see that there were considerable disadvantages to us in having joined late. Even after 18 years one can still see traces of that, as it were, because a lot of the patterns had been set, equipment had been ordered, specifications had been made, before we arrived on the scene. Certainly in the early days, we did bring a lot of expertise in instrument construction and there were quite a number of instruments that one could say in a certain sense were British instruments, where the ideas came from the United Kingdom. I have to say that there is still, I think, a faint shadow cast by that ancient past, particularly when it comes to things like placing orders for large pieces of equipment because the specifications for the reactor and so on in the old days were set before we came on the scene.

I have given the Committee a brief outline of what ILL is and how we came to be there. The other point I made in the paper, to which I should like to draw the Committee's attention, really is a point

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[Continued

concerning the future. With any large installation of that kind—and this is equally true, of course, in the particle physics area—there is a need for very long-term forward planning. The question is, how does one go about. The United Kingdom is very fortunate in the present situation in that we have access to what I think everyone agrees to be easily the world's best reactor base neutron scattering centre and the world's best pulsed neutron source, ISIS, but I think we arrived in that situation a little haphazardly. What I believe would be very suitable for the future is if somehow we could pool these facilities and maybe have joint experiment selection panels between the two so that one could direct experiments to the most suitable installation and, indeed, direct instrument development. For example, we are putting together plans for a modernisation programme. We have a list of instruments projects and ideas for new kinds of sources within the reactor which we are putting together for ourselves. This is an in-house activity. Although it has been done with the wide consultation of the scientific community it has not been done with any overt consultation with other installations. There is no mechanism by which, for instance, we could be told that we ought not to be occupying a certain scientific area because that area should be occupied by another installation. From that point of view therefore we behave rather independently. I think that ISIS does as well. Of course, we each exploit our source in the best way that we can. That automatically leads to a good deal of complementarity. However, I do not believe that this is an entirely satisfactory way of proceeding.

Discussions, I know, are beginning about long-term future needs for neutron sources in Europe, in particular, reactor sources. After all, the ILL will probably have a life time of another 20 years. One ought to start thinking very long before that about what one does next. This is being done for various reasons within the framework of DG XII of the European Community. I have some doubts as to whether in fact that is the correct agency to be undertaking the task. I should like to see something like the European Science Foundation doing such a study. The European Science Foundation was in fact very instrumental in getting the European synchrotron project going. It was, I think, rather successful in co-ordinating the case and putting it forward there. It seems to me a more suitable body to take in that kind of scientific advice that we are going to need rather than the European Community. That is another point that I made in my paper. I am not sure, my Lord Chairman, whether you would like me to stop now and to into some discussion? A number of questions have been sent to me which I could give some remarks on if you prefer.

778. Perhaps we may pause there, Professor Day. There are three things it seems to me that are of interest to start off with. One is—and perhaps Lord Porter knows all about this anyway—how did it come about; was there a slowness in the government machinery which led to our joining late or was it something wrong in the CERN machinery? Where

was the fault, if there was a fault? That is on the question of building up. We should be interested also, I think, in finding out a little more about whether you are satisfied with how the running of the thing works. Are you satisfied that SERC are the right people to deal with it, with the problems of year to year management? Then there is your interesting point about, how do you plan for the future, particularly if you are going to co-operate with other institutions, should it be ESF, should it be the Community DG XII or what? Perhaps you could start with the first point, that is, are there lessons to be learnt from the way it was set up from our point of view?

A. I think the lesson one should learn for the future is to be there at the beginning where there is something new going on and to be reasonably decisive about it without any backsliding. Once the decision is taken I think one should go. The recent history of the SERC's involvement with the European synchrotron project I think shows that. There were hesitations, there was going back, there was coming forward again, and the result was that the United Kingdom had about the share it was originally intended to have but as a result of enormous discussion, which was really rather awkward and difficult.

Lord Porter of Luddenham

779. May I ask Professor Day, my Lord Chairman, whether this was partly a parochial wish on the part of SERC? After all, Rutherford is an SERC establishment, and for very good reasons, quite apart from having more neutrons, as everybody knows, for ISIS. Is that what held us up? Were we trying to hold on to our own thing?

A. Well, no, because of course when we decided to join the ILL it was long before the ISIS question really came over the horizon; it was several years before.

780. 1973?

A. Yes, 1975 I think was when Nimrod closed.

781. That is right, two years in it.

A. I am afraid I am not perhaps a very good person to answer that because I was not part of the discussion at the time.

Lord Porter of Luddenham] I suspect that that did play a part at the time.

Chairman

782. But SERC must have known that the French and the Germans were proposing a joint set-up from the first, must they not?

A. To be fair, my Lord Chairman, I think that there was a considerable wish on the part of British scientists to have their own thing as well and run it their own way and organise the equipment and so on and the specification of the instruments. I think that there is a little bit of that.

783. So you mean it was only when the penny dropped that they were not going to get the money

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for it that they then, as a second best, decided, well, we had better join up with the Germans in the ILL project?

A. I think that there was an element of that, yes.

Lord Sherfield

784. We seem to have dragged our feet in both directions. We were slow to join ILL and then we went ahead with ISIS on our own before we thought about bringing in partners. Would it not have been better if we had started ISIS as an international project from the start?

A. I am sure it would have been if it could have been arranged. I think that it would have been admirable to do that. The origin of ISIS of course was that the accelerator Nimrod was to be closed and therefore all the installations became available and with a certain amount of modification were able to be used for this new purpose. I do not know whether it would have been managerially possible to wait until an international consortium had been got together and, as it were, close the gate on Nimrod and leave it shut for as long as it took to get a consortium together. I suspect that that would not have been really a starter.

Baroness Nicol

785. Professor Day, your paper is quite eloquent on the need for planning and the need for forward planning. Do you have any reason to suppose that your ideas are likely to be adopted? Is there any indication that this kind of planning will take place or are we going to find ourselves in the same position again?

A. I think that there is the nucleus of such a planning group. As I said in the paper, this has come about actually through DG XII for the kind of reasons that these things happen. DG XII has a programme which is called "Large Facilities". This is not in fact for the funding of large international facilities like ILL but it is designed for the enhancement of national facilities to make them more attractive to a wider range of users. For example, ISIS has quite a large grant from that programme for its muon source, the production of muons being a kind of byproduct of the main goal of ISIS, which is the production of neutrons. Thus it is a separable activity in a way that brings a different group of users. As I understand it—and I am not a member of this group—the committee that was looking at the Large Facilities programme really took it upon itself to start having these thoughts about the future neutron sources. Therefore, as these things often do, I think that it has grown.

Lord Porter of Luddenham

786. The Rutherford laboratory is very expensive; it costs considerably more than ILL. What possibilities are there for getting over the problem? We have got ourselves into it. Given that one wants adequate neutron facilities for all the scientists in this country, if we did not have a Rutherford—and

let us start from there—what would be the ideal situation? When you have told us that, how can we work towards it?

A. As I have said, the pulsed neutron sources are really rather complementary to continuous reactor sources of neutrons. The spectrum of neutrons is different in time and energy. One could do different experiments. Supposing that we had access to the ILL only, I think it is quite possible that we would have been seeking to join one of the other spallation projects that have been around. There was a German project called the SNQ, which was a purely German project. A lot of effort was put into it. It was defined in considerable detail over a long period of time. Then finally it was not funded by the German Government. It could be therefore that we might have decided to try to get some access to that for the benefit of people who wanted to use a pulsed source. Also at the present moment the Swiss are building a pulsed source.

787. Perhaps I may put the question another way, my Lord Chairman. One answer obviously—and I am talking about the expense of it all—would be if there were an international shared thing like ILL. If they are complementary and if there is such a need for pulsed neutrons, why is it that we pay for 80 per cent or more of it?

A. There certainly have been efforts. I am afraid that I have not had any part of them so I cannot really tell you. There have been efforts to attract equity partnership from the French and the Germans. These really have not been successful. There is an agreement with the CNRS. It is not, however, a partnership agreement; it is merely an annual grant.

788. Does it mean that the other countries do not find pulse neutrons so much a part of life and so essential?

A. If you take the French example, the French neutron scattering community is not actually large. One of the complaints that the French always make about the ILL is that they always get much less than one third of the beam time. It does not worry them too much about the ILL because it is in France and they get many other advantages to offset the fact that they are not getting so much beam time. One of the reasons that they do not get so much beam time is that it is not a very large community. I should have said that the neutron scattering community in the United Kingdom is significantly larger than the French one. I think the French are taking up probably what they think is reasonable according to the wishes of their scientists.

Baroness Nicol

789. What are the other advantages that you mention?

A. That is a general question, what are the advantages of having such an established site on your territory. There are clearly economic advantages, which I think are really of two kinds. There are local economic advantages. As I said, the budget

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[Continued

of ILL is £30 million a year more or less. Fifty-five per cent of that is in salaries. Almost the whole of that money is recycled into the economy of Grenoble because that is where people live. Also, of course, the ILL is a jewel in the crown of Grenoble because it creates local employment, it brings lustre to the name of Grenoble and so on. On the national level, as I said earlier, there is the question of orders for industry. For example, we have just placed a contract for the interim storage of fuel elements because we have a problem about sending back spent fuel elements to the United States for reprocessing. There were two possible places where we could do that from the technical point of view. One was at Harwell; the other was at Cadarache. In the end, however, it was clear to me that the best solution was Cadarache because it was very close, the transport difficulties are fewer and the circumstances that the French atomic energy authority were able to give us were more favourable because that authority is one of our partners: the partner agency for France is the French atomic energy authority. Therefore, one has this very direct link. I think that is rather typical. There are scientific advantages too to the host country, of course, particularly from my own perspective when I look at the Grenoble scene in that there is a large concentration of other bodies in Grenoble. There is the French national laboratories, the CNRS laboratories and the French version of Harwell is right next to us, two or three hundred yards away. There are always people coming and going and discussing and using our facilities. This is good for us as well as for them, I should say. It is very helpful to have such a large laboratory on the doorstep—and it is certainly very helpful to them too.

Chairman

790. Can you say something about the financial arrangements and how they work, Professor Day? Do you have to go cap in hand to three different people and have long arguments every year? How well assured are you about future financial requirements?

A. We operate of course under an intergovernmental agreement which says that the three associates pay equal shares of our budget. The mechanism is that we propose a budget to them. They meet in the form of what is called a Steering Committee twice a year. The usual format is this: in the June meeting of the Steering Committee we propose our draft budget for the following year.

791. In ecu or what?

A. No, in French francs, because that is where it is spent largely. All the budgeting is done in French francs. As I say, we propose a draft budget to the delegations in the steering committee. Then they tell us what they think they can afford, what their ceiling is. Throughout the summer we look at the consequences of what they can afford in the following year, then in November we go back with our firmed-up proposals.

792. Do you have big problems or not at this stage? Do you have more problems with one country than with another?

A. I would say yes, but the country in question varies with time. It is not always the same country that causes the problems. It is not always the United Kingdom, I should say. This formula of three equal partners I think is a very good one in many ways. Three is a small number, it is an odd number and it is a prime number, but I suppose that does not really matter very much. It is small enough that you really cannot have a majority vote. It is odd and therefore there is always a majority and a minority, but the majority cannot simply go off and ignore the minority if there are only three so there has to be a consensus.

793. You would not like to see it come under the Community?

A. Oh, no, I do not think so!

794. And you would not like to see it widened much except that you have said you would hope Italy might come in?

A. I think that there is a possibility that Italy could join. I believe it is an excellent concept to say that the partners—that is, equity partners—should really be equal partners. I think that that helps enormously. The ESRF next door to us has 11 countries all of whom have different shareholdings. Two or three days ago I went to their Council meeting, which is equivalent to our Steering Committee. That is a very difficult body to work with.

Lord Sherfield

795. Is ESRF operational yet?

A. It is under construction. The construction is going very well. I heard at this Council meeting, in fact, that they hope that they will be able to start up possibly six months ahead of their original schedule, which was to start in 1994, so I think that they may be able to advance the start-up from the middle of 1994 to the beginning.

Chairman

796. What percentage of your costs do you expect to recoup from the people who make use of you?

A. We do not recoup our costs at all. We provide a facility for people coming from universities and so on. It is the equivalent, if you like, of the SERC research grant.

797. You mean they do not pay for it?

A. Oh, no. They write a proposal. It is exactly like getting a research grant from SERC. Lord Taylor of Blackburn

798. You mentioned earlier that you were having to cut back a little this year because your budget was not accepted, is that right?

A. We proposed a budget of 328 million francs for next year. I should say that our budget for the

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current year is 305 million francs, about £30 million more or less. We proposed a budget for next year which would have permitted six reactor cycles of operation with a reasonable indexing for inflation for a constant level of activity. The associates finally settled at 314 or 315 more or less. Now it so happens that we have a number of costs this year that we did not have last year. We had a number of strikes, for example, earlier in the year; the French unions called strikes. We gave them a salary increase which was a little larger than we had anticipated, 4.2 per cent, not too much, but bigger than we had anticipated, and the consequences of that of course are carried forward to future years. We also have such things as the fact that the French Government has changed the rules for nuclear insurance, the sum for which you have to insure therefore having gone up so that the premium we pay has gone up by a factor of six from half a million francs to three million francs. The atomic energy research establishment next door, who have provided all of *services d'intervention*, that is, every kind of emergency service for the last 20 years free, which is very nice of them, have now decided that it cannot be free any more. (One cannot blame them, of course.) That is another 900 thousand francs. There is a whole list of things that were not in the budget last year so we have had to make some small economies. One is a small saving on reactor fuel and operating costs when the reactor is not running. Therefore, we will run 230 days next year instead of 260 days.

799. The staff is international?

A. Yes.

800. Are they paid at French rates or what rates are they paid at—national rates? Does this pose problems?

A. The statute of the institute says that pay and working conditions shall be analogous—a terrible weasel word which has given us a great deal of trouble—to those of the CEA, that is, the French atomic energy authority. In France, the public sector pay is very tightly controlled: it is controlled not only in terms of inflationary increases but also in terms of what is called *la grille* in that there is a tremendous set of tables which tell you exactly what the different grades have to be according to age and to qualifications. That is the format of our salary policy. In addition to that I should say that non-French staff get a foreign service allowance, a *prime de dépaysement*, which is a proportion. In fact, we have just changed the basis. It used to be a proportion of salary; now it is a proportion of the average salary in the institute because we wanted to help the younger technicians more than the people who were at the top of the scale. That adds probably nearly 10 per cent to the salary of non-French staff.

Chairman

801. Do you have any problems in recruiting or not?

A. Yes, and, indeed, this is one of the reason why we changed the basis of the foreign service allowance

last year. We looked at the statistics over five years and found that the proportion of French staff was increasing and of non-French staff, decreasing, that is, non-French staff were leaving and being replaced by French. I should say, my Lord Chairman, that we have 480 staff. Of those two thirds are French. It is in the workshops and the technical areas—in fact, the further one moves away from the experimental coal face, so to speak, the more French the institute becomes. This is one of the reasons for the activity of the unions that I mentioned in calling these various strikes. It was to try to rectify that a little, to make the institute more attractive to non-French staff, that we increased the foreign service allowance. I am very anxious that we should recruit young technicians as well as scientists from Britain, Germany and so on. I think that it is very important.

802. But the staff are limited to the three contributing countries?

A. Where there are job vacancies advertisements go out only to journals and papers in the three partner countries.

803. Swiss?

A. Yes, in addition to the partner countries we have the three scientific members, each of whom pays 1.5 per cent of the budget, so they are very small contributors. As part of their contract they can send us thesis students, who would be paid out of our budget, two for each of those scientific members; and they also have the right to nominate one staff scientist for each country.

Lord Porter of Luddenham

804. I want to ask for clarification of how the comparisons are made to help us with all the international science programmes. You likened your Steering Committee rather to a research council in some ways. The applications go through that?

A. No, I am sorry, let me explain. There are two bodies. There is a Scientific Council, which advises on the experimental programme. The Scientific Council has nine sub-committees.

805. That is not the one I am concerned with.

A. They select the experiments.

806. Yes, I understand.

A. That is the science advisory council, like the Chemistry Committee of SERC, which selects research grant proposals. There is then the Steering Committee, which represents the three funding agencies.

807. If one looks at the research council analogy, the research council like the SERC has to make decisions of CERN against astronomy against chemistry. I am really going to ask you where the fight takes place. Then the SERC has to fight the other research councils within ABRC; and then ABRC has to fight within the ministry and the DES

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[Continued

against other things. Now where is the European decision made between more neutrons and more of something else?

A.I do not think that it is made at the European level. It has been made in the discussion that takes place in private within each of the funding agencies before they come to the Steering Committee meeting. SERC will have decided (particularly the Science Board), what they can afford for our budget in a given year. They will have had their discussion of comparison with synchrotron and other things, of course.

808. Would this discussion take into account the existence of ISIS and suchlike?

A.The United Kingdom discussion?

809. No, the Steering Committee—after all, this is the discussion for us and the other two participants, is it not?

A.The French and Germans are not partners in ISIS. Therefore, the French and German delegations on our steering committee have no cognizance of ISIS.

810. That is very unsatisfactory surely?

A.Yes, indeed.

Chairman

811. This is a very interesting point. Where should all this take place? You suggest that perhaps the European Science Foundation should be somehow the place where one took a broad view about what facilities were required and then how they should be, but it does not have that sort of a council at all, does it?

A.No, not at all. It would have to set up a panel on that subject.

812. When we were in Paris the other day we kicked this problem round and more or less came to the conclusion that, on any idea of setting up a body of 20 wise men or suchlike, if you did find 20 wise men they would not agree with each other, and it is almost impossible to find 20 wise men! If it is not the European Science Foundation and we do not want to get tangled up in the Community, how should it be done?

A.I thought that Lord Porter was really asking the question specifically about neutrons, that is, when these delegations come to our Steering Committee to talk about funding the reactor source of neutrons, how do they take into account that there is another source of neutrons. The simple answer to that question is that they do not; at least, the SERC will have in their private discussions before they come to the Steering Committee, but in the Steering Committee itself they will not.

Lord Porter of Luddenham

813. Yes, that was part of the question; and I was also asking to what extent they discuss the

relative importance, if I have another five million pounds, of having more neutrons or having more telescope or suchlike?

A.Our steering committee does not discuss that because it is a Steering Committee of ILL.

814. Where is that discussed? Where is ILL discussed comparatively against other things?

A.It is discussed comparatively in the United Kingdom context within the council of SERC where the requests of the different boards are adjudicated.

815. So the three countries do it?

A.Similarly it would be done in the BMFT and within the CNRS because the CNRS has a system which is really very similar to ours in that their subscription to ILL actually comes out of the same pot of money that funds research grants so they have in turn debates that are very similar to the ones that take place within SERC: central facilities, research grants, expenditure. But, to my knowledge, there is no supranational equivalent at all.

Chairman

816. One is thinking of a European ABRC, is one not?

A.Well . . .

817. A Council of Europe ABRC?

A.What I was thinking about and what I mention in the paper is something very much narrower than that. Somehow, before starting to compare whether you need more neutrons or synchrotron radiation on the European level, I was addressing the narrower question and possibly more suitable question of how best one apportions the neutrons one has of different types. Some arrangement where one could say there was a European pool of neutron beam time on different instruments that happened to be in different places with the different scientific characteristics for which one could then ask the scientific community to apply on a pool basis I think would be marvellous and very good scientifically. However, that would require an agreement by the French and Germans to contribute into ISIS.

Lord Porter of Luddenham

818. Is there anybody but the the European Science Foundation who could bring that together and do that?

A.As I said, I am not very enthusiastic at the suggestion of DG XII doing it. My thought about the European Science Foundation is that it is a very small body, and that has some attraction. It is not a body that in itself has tremendous power, but it can bring together the people who are needed to make the judgments on particular topics.

819. As it did with synchrotron?

A.Indeed.

Chairman] Professor Day, thank you very much. It has been very helpful to us and we are most grateful to you for having come over and given your time.

*19 December 1990]**[Continued]***MEMORANDUM BY BRITISH AEROSPACE**

I have been asked to respond to your letter to the Chairman of British Aerospace, dated 8 June 1990, which invited BAe to submit written evidence to the Sub-Committee on International Scientific Programmes.

Your letter identifies the range of the investigation as "... across the whole field of international civil scientific and technological research ...". BAe has substantial experience and expertise in international programmes, particularly in the technological area, and thus this response will focus on that sector from an industrial perspective. We note that the nine specific issues, which are identified in your letter, imply the rather different focus of "science" (perhaps "big science") from a government or institutional perspective where we have relatively less experience. Thus our main response will address the general issues but only four of the issues which you have specifically identified.

Notwithstanding the above focus on technology, our Space Systems Company does have special associations with international space science programmes. This experience, particularly in relationship to the European Space Agency, may be helpful to the Select Committee and it is therefore described in an Appendix to our main response.

You will be well aware that the aerospace industry has a long history of international collaboration in all the stages of research, development and production. A description of this collaborative activity was given recently as part of a major study which was carried out by a group of nine European aircraft companies and presented to the Commission of the European Community and to government officials in Member States. An extract from this "Euromart Report" is attached to this submission in the hope that it will provide useful background information for the Sub-Committee. We will of course be pleased to provide copies of the full report, which is a substantial document covering aerospace collaboration, if requested.

The starting point for our evidence is the fact that an increased rate of acquisition of technology is essential for the long-term commercial health of UK manufacturing industry and thus the UK economy. This can be achieved by several means but a key element is the recognition by government that it should play an increased role in supporting UK science and technology. This support should be based both on increased funding and increased efficiency using mechanisms such as international collaborative programmes.

Our experience of collaborative programmes teaches us that they are an increasingly important mechanism which should be embarked upon within a well considered strategy for the acquisition of technology and the development of business interests. These same considerations, albeit from a commercial culture, should also apply to a significant degree at a national and governmental level. Thus international programmes should be developed as part of the process of achieving strategic UK goals in science and technology, and not merely embraced in a piecemeal fashion. Some of these considerations can be included in responding to your first question:

- Q1. "The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions."

The prime advantage of participating in an international collaborative programme is to bring more "resources" to bear on a project which could not be resourced nationally. It should be noted that "resource" includes money, manpower, particular expertise, unique facilities, etc. Money will be an important consideration but it is not the only one. In a commercial environment, and perhaps nationally, it is particularly important to be aware of one's strengths and weaknesses and to use a collaborative strategy to build up know how in weak areas. This inward transfer of external expertise is a key element and may be a dominant reason for collaboration. The converse of this approach is to be aware of one's own "crown jewels" and only to put these into a collaborative programme after the full implications are considered. However, "crown jewel" embargoes must be realistically limited if collaboration, which must be a demonstrably "two-way" process, is to be effective.

The reduction in costs which stem from collaboration will of course be much less than the simple application of "n partners reduces the costs by a factor of n for each". Additional cost factors are: greatly increased management and overheads; costs associated with increased time scales particularly the decision phases; costs associated with the broader objectives to meet the needs of all partners. It is impossible to quantify these effects but they are very significant, perhaps reducing the cost gearing from "n" to " $\sqrt{n}$ ". However, if collaboration can be established with regular partners over several projects, we have found that these "costs of collaboration" will always be greatly reduced as mutual trust and understanding is developed.

- Q2. "The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution."

The location of major facilities is an important factor in strategic developments at a national and corporate level. The French government investment in its Aerospace Industry has been focused in Toulouse

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as part of the strategic development of South West France. This investment covered several major facilities. The European Transonic Wind Tunnel (ETW) at Cologne is a current example of a collaborative investment (by UK, France, Germany, Netherlands) which is seen by Germany as a major plank in their policy of building up the Aerospace Industry in North Rhine Westphalia. The German government and Lander are willing to pay an additional premium (38 per cent of construction costs *cf* 28 per cent by France and UK), in recognition of such benefits. This 10 per cent premium is good value for money when set against the wide range of local goods and services to be purchased, the stimulus to local science and technology and the potential for further industrial and commercial growth around the nucleus of the established facility.

Q3. "The machinery whereby international programmes are set up and its adequacy in the UK with specific examples were appropriate."

For international programmes, an internationally acceptable machinery is required. In our experience, the machinery developed by the Commission of the European Communities for the R&D Framework Programme, which includes liaison with national government agencies, is an effective "institutional" form. The Aeronautics Programmes (Area 5 in Brite/Euram), which was established following the EUROMART Report, is a good example of using this machinery. For programmes with a more limited participation, intergovernment (or inter-industry) MoUs/Agreements are well established as a procedure. A good example of this is the GARTEur Programme which entails close liaison by both governments and industry on an international scale.

Q8. "impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing travel and family charges exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions"

This question covers the practical features of international collaboration. Many of the items are additional overheads which result directly from the collaboration. They should not be considered as "impediments" (which suggests that they were only noticed after the decision to collaborate), but as an important element in the strategic decision of whether or not to collaborate. The reference to IPR as an "impediment" also suggests that IPR is considered as an afterthought when again it should be considered at the very earliest stages when the strategy of collaboration is set.

We have very little direct experience of the subjects covered by the remaining questions and therefore would prefer not to make general comments. Please do not hesitate to contact Mr J Arnall (Head of R&D, BAe Headquarters) on (0252) 383282 if you have any queries on those topics which we have covered.

Yours sincerely,

Deputy Chief Executive (Engineering)

Enclosures:

1. *Extracts taken from Euromart Report:*
Foreword
Pages 30 to 34
Pages 162 to 175
2. *Appendix—Space Science and Technology*

APPENDIX

ADDITIONAL EVIDENCE ON SPACE SCIENCE AND TECHNOLOGY

I. INTRODUCTION

The intrinsic high cost of space programmes results inevitably in international collaborations. The last specific technology-driven space programme receiving sole funding from UK sources was Miranda (also known as X-4), launched in 1974, and the last all UK space science mission, UK6, was launched in 1979. This excluding MOD operational programmes, all space science and technological spacecraft research programmes are either of a bi-lateral, or multi-national characteristic, either within or outside the European Space Agency (ESA) framework.

European Space Agency Programmes

It is most important to note that a significant part of the UK Space Industrial sectors capacity is now directed to the Technological Research and Development Programme of ESA. The principal objective of this programme is to develop and enhance European capabilities in the exploitation of space for scientific and commercial activities.

ESA provides a profound influence on the direction taken by UK space industry and ESA's entire programme falls within the scope of the Sub-Committee's enquiry. ESA's programme may be considered in two parts: the core (mandatory) elements and the optional elements. Individual countries may decide to what level they contribute to optional programmes. The value of contracts placed in individual States by ESA is strictly in line with the level of support provided.

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Multi-National Programmes

Multi-national programmes have been established both with the UK as a direct participant and also with the UK involved via ESA. Small programmes tend to be bi-lateral agreements; typically, for example, the collaboration on specific instrumentation for scientific or earth observation spacecraft. These provide scientific return and maintain UK presence in space science research, with a high profile but they do not provide a significant industrial stimulus to UK companies. This can only be achieved by UK participation in larger international programmes. These have the potential for significant industrial return, in enabling the development of key technologies, whilst also providing an important stimulus to the scientific community.

It is particularly timely for the House of Lords Committee to be considering the issue of international scientific and technological research programmes, due to the discussions surrounding three major programmes having a substantial space element. These are: the US Global Change Research programme which includes Mission to Planet Earth and has a quoted value of around \$50 billion; the Bush Initiative, otherwise called the Space Exploration Initiative, directed to the return of man to the Moon and man's presence on Mars for the first time, a programme having a quoted value of around \$200 billion; Japan's World Environment and Disaster Observation System, which may consist of in excess of 30 orbiting space elements. These programmes are in addition to the International Space Station (US Freedom and ESA Columbus) which is now reaching maturity. Collaboration within these larger programmes is clearly more complex, requiring intergovernmental agreements to protect the interests of UK science and industry. If the UK is to participate in these programmes, therefore, it must be certain at the outset that a return on UK investment is to be forthcoming. ESA participation in very large programmes is likely to be as a minority partner, perhaps 15 per cent or 20 per cent, with the USA playing a dominant role. In such cases, particular attention must be paid to the formulation of the MoU and subsequent management arrangements if Europe is to achieve a proper return for its investment.

2. ISSUES RAISED BY THE SUB-COMMITTEE

- Q1. "The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions."

ESA has provided a coherent long-term programme which has been beneficial to UK industry in providing the capability for the development of key technologies. It has also provided a core scientific programme which has enabled UK scientists to participate at the frontiers of space physics. It is most unlikely that either of these capabilities would have been achieved in the absence of ESA's programme, and UK participation therein.

The major advantages deriving from international participation are:

- At a scientific level, UK scientists are able to compete effectively in the international environment. One can look historically and see this through successful programmes such as International Ultra Violet Explorer Satellite (IEU).
- The capabilities of an existing mission may be significantly enhanced.
- Missions can be undertaken which could not be contemplated even within ESA's budget—for example, the Cassini mission being defined at present could not go forward without NASA's co-funding.
- Depending upon the type of collaboration it is possible within the context of an international programme to develop technologies to enhance our industrial competitiveness.

- Q2. "The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution."

There are no large ESA facilities in the UK. This is a significant disadvantage to the UK in promoting space to politicians, scientists and engineers. Such a facility could have been a key infrastructure element to the UK space industry. It is perhaps notable that Paris is the home of ESA's headquarters.

- Q3. "The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate."

- Q4. "The technical and financial criteria under which proposals for ISPs are presented or considered."

- Q5. "The forums in which the decision to participate in ISPs is normally reached."

The ESA machinery has generally worked well as a co-ordinating agency for space activities in Europe. In particular it has been well aware of the need for prime contractorship for the successful completion of programmes.

- Q6. "Government practice and guidelines on ISPs—how they apply and how widely they are known and accepted."

It is the British National Space Centre's role to provide the guidelines and set policy for involvement in ISPs. Funding for the programmes is derived from supporting departments. (DTI, MOD, DES, DOE).

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Q8. "Impediments within the UK to engaging in ISPs . . ."

With regard to ESA's programme the most significant impediment to participation is the relatively small financial contribution made by the UK.

3. SUMMARY CONCLUSIONS

- (i) The framework of the European Space Agency's programme is encompassed within the terms of enquiry of the Sub-Committee. This programme provides a major stimulus to the UK space industry.
- (ii) The major advantage to UK industry of participation within ESA's programme is that it provides a long term cohesive plan which enables the development of industrial competitiveness. This requires a collaborative approach between Government and Industry, if full benefits are to be achieved.
- (iii) For large international programmes, extending beyond ESA, it is essential that an appropriate framework is set up to enable the UK to participate in core, strategic technology areas.

FOREWORD

This EUROMART¹ Study Report describes the work and findings of a study carried out by a group of nine European aircraft Companies in the period from February 1987 to February 1988. The main focus of attention in the study was the status of, and future need for, research and technology acquisition in the European Aeronautics Industry. It is important to emphasise that in referring to "research and technology" this report confines itself to research and technology activities which are not project-specific and which precede the "development" phase during which the design and proving of a new or modified aircraft is carried out: technology demonstration activities are included in this definition of research and technology.

The Group, comprising representatives of the following Companies,

AERITALIA SPA
AEROSPATIALE SNI
AVIONS MARCEL DASSAULT—BREGUET AVIATION
BRITISH AEROSPACE PLC
CONSTRUCCIONES AERONAUTICAS SA
DORNIER GmbH
FOKKER AIRCRAFT BV
MESSERSCHMITT-BÖLKOW-BLOHM GmbH
SOCIETE ANONYME BELGE DE CONSTRUCTIONS AERONAUTIQUES,

conducted the Study. The Study was funded jointly by the Industry and the Commission of the European Community under the terms of a contract (Ref. ECI-1539-B7210-B).

The EUROMART Study report is published in response to, and in formal satisfaction of the requirements contained in Annex 1 of that contract.

5. EUROPEAN COLLABORATION

5.1 Introduction

The co-operative ventures developed by the European Aeronautics Industry over the past decades are well ahead of those prevailing in other industrial sectors and have done more to promote faith in Europe than many administrative provisions. A strong aeronautics industry should be recognised at the highest level as essential to the promotion of a European identity and, in addition, as offering the smaller Member States of the Community the opportunity to be able to contribute to highly advanced technological programmes. This can be a powerful contribution to European unity.

Europe on a collaborative basis can command a substantial part of the total aircraft market. As has already been demonstrated in a number of successful programmes, the European Aeronautics Industry can by concerted action obtain a substantial increase in market penetration, enabling higher levels of manufacturing productivity to be achieved.

In the civil field, for instance, the Airbus Industrie share by value of the US-dominated market for short and medium-haul aircraft larger than 100 seats was increased from 5 per cent in 1975 to 33.5 per cent in 1987

¹Joint Study of *EURO*pean Co-operative Measures for Aeronautical Research and Technology.

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(Fig. 1-13). The Airbus family, which does not yet offer the whole range of commercial jet transports, already holds 16 per cent of the whole sales of this aircraft category over the past five years, as much as McDonnell-Douglas.

In the military field the collaboration between the European governments and industries on the Tornado programme has provided a baseline 800-units programme, allowing the competitiveness and long-term user confidence, which has for long been an asset to the US industry, to be used as a spring-board for major export sales.

The next figures show the typical relationships between production run and cash curves which directly affect competitiveness. The higher the number of production units the lower the cost of the units themselves, thus diminishing the mean costs required to be reimbursed by the market for the overall production (Fig. 1-16).

The typical integrated cash flow curve (Fig. 1-17) shows clearly that (for the particular example selected) aircraft programmes will only be an autonomous commercial success (not taking into account the follow-up opportunities) after a production run of at least 150 units sold/paid. The size of the home market as the base for the commercial undertaking in most cases will determine the success or failure of a programme.

Despite the vast resources of the US and its commitment to its aerospace industry Europe's financial and technological resources are, nevertheless, sufficient in total to enable it to compete in a free aeronautical market, provided that there can be effective collective organisation and action.

Whilst Japan is not so committed to aerospace at this time, it is very probably the most committed nation in the world to research and development supporting dependability, quality and innovation. European nations unilaterally cannot match Japan's effort in scale given the disparity in population and industrial output; what can be matched is Japanese concentration on important programmes by setting priorities and goals within a collaborative strategy and organising combined resources in the most effective way.

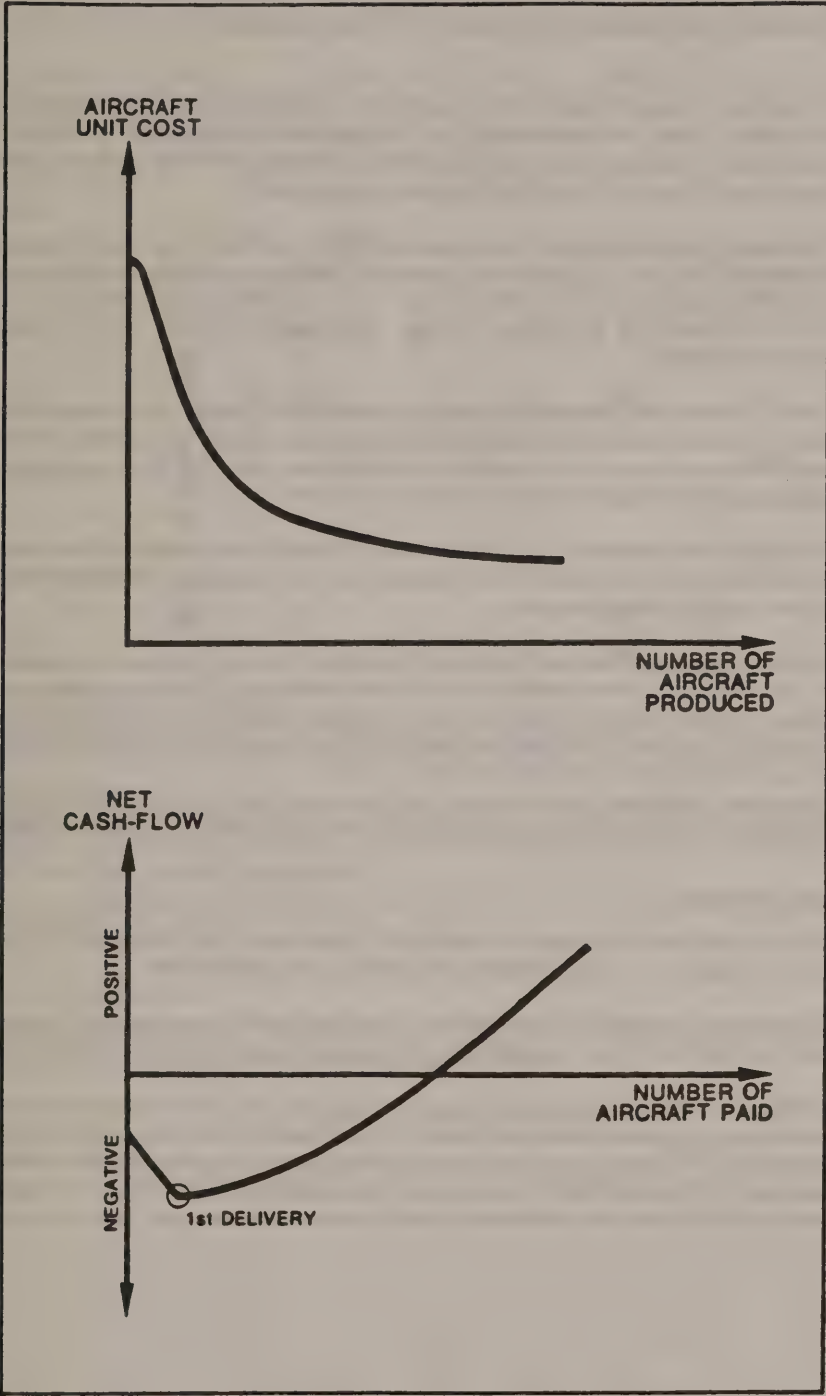


Fig. 1-16 (top) and Fig. 1-17 (below)

An example of the influence of production run on the overall economy of an aircraft build programme

The European Aeronautics Industry has a demonstrated capability and excellent record of achievement on collaborative projects, and in the development and use of advanced and innovative technologies. The industrial restructuring of the aircraft sector carried out in Europe in the 1960's, which resulted in work sharing and multilateral co-operation, has been a major contributory factor to its consolidation and continued strength (see Annex 12, Sect.4).

Limitations in human resources, research facilities, finance, and time for what is seen to be a required increase in total research and technology activity will call for further development by collaboration addressing clearly formulated goals, objectives and market opportunities.

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5.2 Product Collaboration

The importance of European product collaboration has increased rapidly since the early sixties. Nowadays, almost every major aircraft programme in Europe is launched on a collaboration basis (Annex 12).

These programmes are placed either directly under the responsibility of all partners (Concorde, for instance) or, more often, under the responsibility of a consortium created by the partners. Generally, they include development and series manufacturing, but sometimes they are almost entirely limited to this latter activity (as in the Lynx, Puma and Gazelle helicopter programmes).

The balance between development and series manufacturing cost, and the capital resources of different Companies condition the need for co-operation. Indeed, the development of an entirely new commercial jet aircraft may now cost around ECU1-10 billion, over a period of five years, and have a unit production cost between ECU20-50 million (according to the size); and still more for the development of a multi-purpose combat aircraft.

In practice, there is against this theoretical benefit an undoubted penalty in the loss of the advantages of singlepoint control in prime-contractor/sub-contractor operation. Actual experience has fallen short of the theoretical division of launch costs by the number of participants and the effect on single production line learning of multiplying the production outlet by the same factor.

Product collaboration itself imposes a cost and not all the factors in the collaborative formula are positive. In the process of determining the project to be pursued and the means of achieving them the European industry has had to weigh up these factors.

Civil aircraft products are designed for World marketability. Indeed, the national markets are too small to be profitable; they could not satisfy more than half of the sales target of these programmes. Collaborative military programmes, initially defined to answer military requirements of the countries concerned, have an important active market, and are not so preoccupied with export sales, but the larger base market provides a springboard to sales outside the partner countries.

As regards European helicopter collaboration, which started later than co-operation for fixed-wing aircraft, this often begins with military programmes from which civil versions are derived (Fig. 1-18).

5.3 Technology collaboration

The launch of new aeronautical products which offer important improvements over previous product requires that new techniques and technologies are studied and validated first.

These research tasks were generally undertaken on a national basis by aerospace Companies themselves, often jointly with national scientific organisations, by internal financing or with the help of public funds.

During the seventies, it became more and more obvious that the cost of important research activities preceding development programmes were increasing. It also became clear that co-operation was necessary for the successful conduct of these activities. The required collaboration was therefore developed, directly between the aerospace Companies, under the aegis of European organisations such as the EC, of between aerospace research organisations and Government-rund research institutions (Fig. 1-19). See also Annexes 10, 11 and 13.

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[Continued

Fig 1-18 Some of the European Aeronautics industry's collaborative programmes

	AS	AMD-BA	AIT	Bae	CASA	DORNIER	FOKKER	MBB	SABCA	OTHERS SHORTS, AGUSTA WESTLAND
Civil Aircraft										
Airbus A300/310/320/330/340	●			●	●	●	●	●	●	
ATR 42/72	●		●							
Concorde	●			●						
Fokker F.27/Fo-50, F.28/Fo-100		●					●	●	●	●
Military Aircraft										
Jaguar		●		●						
Tornado			●	●				●		
Alpha Jet		●				●			●	
EFA			●	●	●	●		●		
Transall	●							●		
Atlantic -1/-2	●	●	●			●	●		●	
Helicopters										
Puma	●								●	●
Gazelle	●									●
Lynx	●									●
EH 101									●	● ●
HAP-HAC/PAH 2	●							●		
NH 90	●						●	●		●
A129 LAH					●		●			●

These collaboration projects covered:

- Techniques and technologies which are applied to aircraft (such as aerodynamics, structures and materials, computers and computing techniques) which could possibly lead to demonstrator aircraft realisation.
- Techniques and technologies aimed at reducing development and manufacturing cost (new and automated manufacturing processes, CAD-CAM systems and tools and methods which allow better overall programme management).
- Studies of continued use of very large test facilities and the provision of further such facilities (wind tunnels, for instance).

5.4 Other Areas of Collaboration

The European Aeronautics Industry is also involved, either directly or indirectly, in other collaborative organisations and projects (excluding subcontracting and licences):

Fig. 1-19 Organisation/Country Chart

Organisation	EC	OECD	AGARD (NATO)	EUROMART (EC)	EUREKA	GARTEUR (Research Institutes)	ESA (Space)	AECMA
Country								
Belgium	+	+	+	+	+	—	+	+
Denmark	+	+	+	—	+	—	+	+
Eire	+	+	—	—	+	—	+	—
France	+	+	+	+	+	+	+	+
Germany	+	+	+	+	+	+	+	+
Greece	+	+	+	—	+	—	—	—
Italy	+	+	+	+	+	—	+	+
Luxembourg	+	+	+	—	+	—	—	—
Netherlands	+	+	+	+	+	+	+	+
Portugal	+	+	+	—	+	—	—	—
Spain	+	+	+	+	+	—	+	+
United Kingdom	+	+	+	+	+	+	+	+
Others	/	+14	+4	/	+6	/	+4	+2

- Collaboration outside the EC

European aircraft manufacturers have launched programmes in collaboration with Companies in countries which want to develop their own aeronautical industry. As regards collaboration with US aircraft Companies, there have been many subcontracts from US manufacturers to European

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[Continued

Companies. There have also been many attempted agreements to organise real collaboration (recently between Airbus and McDonnell-Douglas for long-range transport) but very few programmes have been launched; the VTOL strike aircraft Harrier AV8B and T45 Goshawk are examples of successful collaboration.

— Engine Manufacturers

The collaboration evolution has been different from that of aircraft manufacturers. There were collaboration agreements between European engine manufacturers jointly with aircraft programmes in order to develop specific engines (e.g., Tornado/RB199). Co-operation with the USA, and even more widely with Japan, took place in order to develop and market new engines such as SNECMA/GE with the CF6 and CFM56 turbo-fans and UDF prop-fan, and the IAE group with the V2500 turbo-fan.

— Regulations and Standards

Collaboration is growing between national airworthiness authorities, European aircraft manufacturers and AECMA in order to create European Regulations (which are almost finalised with JAR25 for some types of aircraft) and standards; this is all the more important now since new technologies (fly by wire) and new types of aircraft (tilt-rotor aircraft) have appeared (see Annex 13). Negotiations are conducted with USA Airworthiness Authorities on these matters.

1. INTRODUCTION

As described in Chapter 1, there now exists in the European Aeronautics Industry a large and increasing number of collaborative commercial ventures. The extensive experience gained over the past twenty years or so, and the success thus far achieved, has greatly raised the level of confidence and competence of the participants in this method of working. Collaborative working is not only seen to be practicable but to have significant economic advantages. Virtually all major aircraft production programmes (whether here on in N. America) are based on partnerships of one form or another. And while some of the projects presently underway in Europe do involve “outside” partners, the great majority of the co-operation is between Companies within the Community.

This EUROMART Study, however, is concerned not so much with co-operation in respect of particular products but with collaboration in the conduct of research and technology. Here the picture is much the same: Some of these are effective and some less so. Certainly, for those not directly involved, the diverse nature, scope and affiliation of these various bodies requires some explanation. It is therefore the purpose of this present Chapter to review present arrangements, assess their merits and shortcomings, and to propose a new overall approach to the conduct of aeronautical research and technology in the European Community, one which reflects the findings of this Study and meets the requirements identified and described in the preceding Chapters.

2. REVIEW OF EXISTING CO-OPERATION IN RESEARCH AND TECHNOLOGY¹

2.1 Co-operation by Information Exchange

The simplest form of co-operation is informal discussion and the exchange of information on technology study results and findings, etc. Co-operation of this kind most commonly occurs between Companies engaged on a common project, or through the medium of professional institutions and societies, universities, etc., and particularly international meetings and conferences, such as those organised by ICAS. Another prominent promoter of conferences and lectures is NATO’s Advisory Group for Aerospace R&D, based in Paris. This organisation, set up some 35 years ago to provide advice to the NATO Military Committee, runs a series of technical panels representing all the aeronautical disciplines with a total membership of approximately 450 scientists, engineers, and military personnel appointed by the authorities of the various NATO nations (Annex 10).

Co-operation at this sort of broad international level does not normally extend beyond exchange of information (and even this is frequently restricted—particularly in the military context—by considerations of security interests and technology transfer regulations). Within Europe, however, the situation is much more encouraging.

¹ Annex 11 deals with European institutions for co-operation in research and technology, and Annex 12 with European co-operative aeronautical programmes which are product-orientated. The many acronyms in this Chapter are explained in the List of Abbreviations which appears at the end of the report.

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2.2 Co-operation involving Government Research Establishments and Industry

The exchange of information occurring under the aegis of AGARD (mentioned above) is directed at improving the defence posture of the NATO nations. Another important stimulus to co-operation is the desire to work more effectively and economically. A good example of this is GARTEUR which came into being with the objective of optimising the resources of the national research establishments of certain nations, in particular by avoiding wasteful duplication of effort. GARTEUR, which is governed by a memorandum of agreement between the participating nations (France, Germany, Netherlands, and the UK) specifically addresses aeronautical research and technology. It relies mainly, but not exclusively, on the four principal research establishments of the member states. Through its management, which is of an unusually sophisticated form, it sponsors and to a somewhat limited extent co-ordinates certain programmes within these establishments and, to an even lesser extent, some research and technology activities within industry. There is no GARTEUR common budget (see Annex 11).

The co-operation primarily between national research establishments, which occurs under GARTEUR, is mirrored by a corresponding industrial grouping, CARTE. Its purpose is to monitor GARTEUR activities and provide comment and advice, where appropriate, with the object of influencing the programmes to help in meeting industry's commercial objectives.

GARTEUR/CARTE constitutes an example of Government-led collaboration which brings together government, industry, and national research establishments in the pursuit of common objectives.

The only European example of a multi-national Government establishment dedicated to research and technology—and related albeit marginally, to aeronautics—is the Institut de Saint-Louis, a Franco-German research organisation wholly managed on a bilateral basis and reporting to the two sponsoring nations' Departments of Defence (see Annex 14).

2.3 Co-operation on the Infrastructure to support Production Programmes

Reference was made in Chapter 1, Section 5, to co-operative programmes for the design and manufacture of specific products, both civil and military. Such programmes having become increasingly common, the need was recognised for co-operation in improving the infrastructure on which these programmes rely—for example, in regard to information, communication, regulations and standards, and design and production technology. Some of this work now goes on within specific project-orientated organisations but when the demand arises bodies such as EUREKA and ESPRIT (Annex 11) provide an appropriate forum, particularly at present) in respect of information technologies and computer-integrated manufacturing.

Regulations and standards can have profound effects on aeronautics industry products, in terms of cost, timescale, operation and marketability. The Study proposes that:

Continued joint efforts to work towards common European approaches and standards for airworthiness certification regulations should be encouraged by industry and official bodies.

Further joint work should be undertaken to seek a higher level of standardisation for aeronautics industry purposes of materials, components, equipment and methodologies.

Industry has also developed a number of co-operative ventures aimed at providing the technology base necessary to support the product programmes. For instance, several Companies worked together in the formation of ACOTEG (Annex 11) to further their common objectives in the field of advanced composite materials and the allocation of these materials to aerospace products. ACOTEG also co-ordinates individual company programmes to avoid undesirable duplication.

2.4 Co-operation in Provision of Test and other General Facilities

Virtually all major co-operative aeronautical production programmes involve the use of specialised facilities—for example, for test and demonstration purposes. One such facility, of major importance and used by many nations, is the DNW, or Duits-Nederlandse Windtunnel (described in Annex 14). This is Europe's largest atmospheric closed-circuit tunnel and is funded by the Dutch and German Governments. An even larger and more ambitious project is the European Transonic Windtunnel (Annex 14) now being built in Cologne, with support from the Governments of France, Germany, Netherlands, and the UK. When this tunnel becomes operational in the mid-1990s it will be a self-financing commercial venture. Experience in Europe has shown that arrangements for establishing and operating common major aeronautical facilities need to be developed on a case-by-case basis. At present, the main subject of interest, which should be jointly investigated, is the possible establishment of a parallel computing centre.

2.5 Co-operation in Training and Education

Several representations were made during the course of the Study about alleged deficiencies in the content and relevance of syllabuses open to students wishing to gain qualifications in disciplines appropriate to the aeronautics industry. There has also been criticism of present education facilities from employers faced with increasing difficulty in finding new staff competent to work in many of the newer and more esoteric technologies to be found nowadays in the industry. It is concluded that a new initiative is required by the various parties concerned if the present deficiencies are to be remedied.

One example of a specialised education establishment, multi-national in character and expressly serving the interests of the aeronautical community, is the von Kármán Institute for Fluid Dynamics Research (Annex 10), in Brussels, founded by NATO. This is essentially a post-graduate teaching and research organisation, the extensive experience of which will be valuable when this subject comes to be examined. A number of national education institutions have also gained a reputation in the provision of internal training courses in aeronautical subjects, notable among them Cranfield, in the UK and ENSAE, in France (Annex 4).

The Study recommends that:

- Close alignment of training arrangements for selected key scientific and technology fields should be established or extended. Major areas involved are computation, software engineering, software management, CAD/CAM, artificial intelligence.
- Investigations into improved co-ordination of post-graduate education in aeronautics should be considered, including possible new or developed establishments, links between existing schools/universities, scholarships, student exchanges, and industrial experience programmes.

2.6 Summary of Relevant Study Data

Fig. 6-1 lists the most important existing European co-operation schemes in aeronautics research and technology, entries being arranged to show the relationship between the participants in the scheme and the type of co-operation concerned. More detailed information about the entries appears in Annexes 10 to 14, the format used in these Annexes being as shown in Fig. 6-2.

It should be noted that only co-operation schemes organised according to some formal pattern and having some clear relationship with aeronautics research and technology were considered. Where schemes cover several types of activity (e.g., standards plus research and technology) they were attributed to the dominant activity.

2.7 Strengths and Weaknesses of Existing Co-operation Schemes

A review by the EUROMART Working Group concerned of the various co-operation schemes shown in Fig. 6-1 exposed the several strengths and weaknesses inherent in collaboration of this kind.

Fig. 6-1 Existing European co-operation schemes in aeronautics research and technology

Type of Co-operation & Organisation involved	Participant(s)	Government	Industry	Research Establishments	Test Establishments	Educational Organisations
Information Exchange	AGARD (NATO)	Main support	Contribution	Contribution	—	—
	Technical Societies	Contribution	Sponsor	Contribution	—	Main activity
	Universities	—	—	—	—	Main activity
Research and Technology	ACOTEG	Support	Main support	—	—	—
	AFARP	Management & Funding	—	Execution	Execution	—
	BRITE, ESPRIT and other CEC initiatives	Support	Main support	Contribution	—	—
	EUREKA	Support	Main support	—	—	—
	IEPG/EDIG	Funding	Support	Contribution	—	Contribution
	IEPG/EDIG	Main support	Main support	—	—	—
Related Activities (Standards, Airworthiness, Education, etc.)	GARTEUR/CARTE	Main support	Main support	Execution	—	—
	AECMA	Support	Main support	—	—	—
	JAR	Funding	Contribution	—	—	—
	VKI (NATO)	Funding	—	—	—	Main activity
Infrastructure, Facilities	DNW	Funding	User	User	Main activity	—
	EAN	—	Design, operation & use	—	—	—
	ETW	Funding	User	Contribution	Main activity	—

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[Continued]

EUROMART Study		Joint Study of European Co-operative Measures for Aeronautical Research and Technology	
ASSESSMENT OF TECHNOLOGY COLLABORATION SCHEMES			
Collaboration		Mark all appropriate boxes or columns with x	
<u>Base Technology</u>	<u>Enabling Technology</u>	<u>Applications Technology</u>	
Basic Research work	Applied Research work	Demonstration Project	
Supporting Facilities	Standardisation	Other Measures (a) (Specify below)	
Basis of Activity	1 2 3 4	(b) See below for definitions of 1-4	
		Effect on Industry	
		Low	High
		Advantage	Disadvantage
1	Level of Operational Arrangements		
2	Status of Organisation/Management Structure		
3	Level of Organisational Flexibility		
4	Level of Continuity		
5	Range of membership		
6	Redundancy with other collaborations		
7	Applicability to Aeronautics		
8	Level of Involvement of Industry		
9	Technology Topic Freedom		
10	Priority in National Funding		
11	Level of International Funding		
(a) Other Measures—e.g., planning, monitoring, training, education, etc. Specify:			
(b) 1. Discuss and exchange results 2. Adjust individual programmes and share results. 3. Establish and execute shared programmes. 4. Establish and execute integrated programmes (Depend on others' results).			
Make additional comments on separate page.			

Fig. 6-2 The forms used during the Study to collect data on existing collaborative research and technology schemes

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On the positive side, among the most important advantages of such schemes are that:

- They provide means of enhancing co-operation in the development and manufacture of products. (For instance, when several Companies work together on a project involving the use of CAD/CAM this leads to the establishment of a common approach, methods, and language, and perhaps even industry-wide standards being created.)
- They allow more effective exploitation of available resources and activities by avoidance of undesirable duplication. (For instance, when two or more Companies separately conduct research into, for example, noise suppression in aircraft cabin structures, there inevitably will be large overlaps in the ground covered, in terms of test equipment, computer programs, etc. A joint approach to the solution of the problems not only affords savings in regard to the hardware and software required but also in respect of expensive skilled manpower.)
- They give access to a wider range of resources in the participating nations. (Facilities available for R&T purposes in one country may not be available in another. Multi-national co-operation usually gives participants access to a wider range of facilities which is of advantage to all concerned.)

These strengths outweigh the several disadvantages inherent in co-operation schemes, among which are:

- Increased costs compared with single-enterprise activity (mainly because a greater amount of co-ordination is involved and overheads are higher.)
- Extended timescales and delays in setting up projects because of the more complicated decision-making processes and arrangements, etc.
- Complexities arising from communication, increase in travel, administration, etc.

It is interesting that while, within any particular co-operative venture, there will be an avoidance of duplication, unless events are very carefully monitored there exists the possibility that, as co-operation schemes proliferate, the same areas of work are addressed under different schemes drawing on different budgets.

3. REVIEW OF EXISTING METHODS OF MANAGING CO-OPERATIVE RESEARCH AND TECHNOLOGY PROGRAMMES

Amongst the many options, three particular forms of co-operation to offer promise as a possible basis for management of the proposed new EUROMART programme.

1. GARTEUR/CARTE has already been mentioned (in Sect. 2.2, and is described fully in Annex 11). GARTEUR was formed in 1973 as a multi-national organisation (F, FRG, UK) with the Netherlands joining in 1977. It is governed by a Council which has established Groups of "Responsables" covering the following disciplines:

- Aerodynamics.
- Flight mechanics.
- Structures and Materials.
- Propulsion Technology.
- Helicopters.

These Groups, in turn, control a number of Action Groups each responsible for an individual task. Members of Action Groups are drawn from Government establishments and industry. The organisation has operated successfully over the years and has sponsored many collaborative programmes. It brings industry and Governments together and provides a valuable role in international collaboration by avoiding duplication and maximising the use of resources. Its disadvantages from the EUROMART point of view are that it has no common budget, its funds being modest in size and allocated on a purely national basis, it represents only a few member states and it is primarily an inter-Governmental body: moreover, while the role of industry, exercised through CARTE, is important it is nonetheless subordinate in character.

2. EUREKA was established in 1985 as the result of a French initiative. It is aimed at strengthening the European base of technology research through industrial collaboration in order to improve the world-wide market for a wide range of industrial products and services (see Annex 11, Section 3). It encourages industry to co-operate on projects with a minimum of interference from State bureaucracy. Proposals are put forward by Companies in a consortium to their own National Co-ordinator who examines them in conjunction with the appropriate Government department. A conference of Ministers meets every six months to consider proposals and awards the label "EUREKA" to those which are approved. When a project is labelled "EUREKA" it qualifies for national funding, the level of which is established by National Co-ordinators in association with Government departments. Funding is on a purely national basis: there is no common budget.

EAI Companies have participated in several EUREKA projects. Foremost amongst these is a group of projects put forward by a consortium consisting of Aeritalia, Aerospatale, British Aerospace, CASA and MBB. The main projects which have been presented by the EUROMART Companies and given the EUREKA label are as follows:

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[Continued

(a) APEX

- An information exchange proposal aimed at providing the necessary infrastructure to support the full range of engineering data and its use in collaborative projects.

(b) EUROPARI

- A drive towards total integration of the manufacturing process from the preliminary design stage through manufacturing and quality assurance.

The EUROPARI framework comprises:

- * SPIDER — Integrated small metal parts design and manufacture.
- * EIFAS — A flexible assembly system.
- * SPACE — Automated electrical cable harness manufacture.
- * ECRAS — Automated composite-material parts manufacture.
- * PARADI — Automated production management of groups of workshops.

(c) AIMS

- The objective is to supply European aerospace manufacturers with a distributed knowledge-based management system for the development and maintenance of embedded software.

(d) EUROFAR

- A high-quality air transport system combining fixed-wing and rotorcraft technologies. It would permit short or vertical take-off from sites near city centres and would compete with existing surface transport.

(e) FORMENTOR

- Methodology and real-time software based on artificial intelligence to monitor complex systems such as aircraft, nuclear plants, and oil rigs and to prevent malfunctions.

(f) AAA

- An advanced amphibious flying boat for use in environmental roles in which land-based aircraft cannot operate.

(g) COMPOSITE CERAMICS

- Application in axial flow gas turbines.

EUREKA collaboration has provided valuable experience in the type of operation likely to be required for the conduct of the proposed EUROMART scheme. In particular, EUREKA has the merit of assigning industry the lead-role in regard to project generation, performance and exploitation. In the context of the EUROMART objectives, however, it does have some shortcomings.

- (a) EUREKA has no common budget. Hence, any proposed arrangement between industrial partners has to be referred for agreement to the various (unco-ordinated) governments concerned. If only one of these withdraws its support for the project the other partners are obliged to devise or seek alternative work-sharing arrangements, find other means of funding, or abandon the project.
- (b) EUREKA aims to be product-orientated and cannot in principle support projects which are directed exclusively to the acquisition of technology. This need to link EUREKA projects to specific markets can cause difficulties for long-term research and technology programmes. The five Companies who were signatories to the Memorandum of Understanding on EUREKA in October 1985, prepared a project named EUROTAP, which is an extensive aircraft technology programme covering advanced materials, in-flight technology demonstration, aerodynamics/aerothermodynamics, and advanced flight management. However, it was deemed more appropriate to incorporate this in the EUROMART rather than the EUREKA programme.
- (c) EUREKA is open to any industry. Consequently, an aeronautical project may have to compete with projects on agriculture, pharmacy, energy, etc. This is not compatible with the necessity for long-term planning of aeronautical research and technology efforts. In fact, most of the projects put forward by EAI Companies under the EUREKA programme, apart from EUROFAR and some aspects of AAA, have not been exclusively aeronautical in character. They have pertained to subjects such as data exchange, software engineering, and CIM and consequently have been of interest to various other industries.

3. The third option to be considered is the CEC-sponsored collaborative ventures (Annex 11, Sect. 2):

ESPRIT — Covering research in information technology.

BRITE — Covering basic research in industrial technologies. It deals particularly with:

- New materials and production technologies.
- Production technologies for flexible materials.

EURAM — Covering research into advanced materials. It deals especially with materials developed upstream of manufacturing industry.

RACE — Covering research and development into advanced telecommunication technologies.

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All four collaborations are open to industries within the EC. They must involve more than one State and may include universities and research establishments. Funding is shared 50/50 between the Commission and the appropriate consortium, the EC funds being drawn from a common budget.

CEC collaborations have a number of proven and valuable advantages.

- Strongly structured and managed.
- One single budget.
- Substantial scale of operation.
- Role of industry predominant.

There are, however, some negative aspects.

- No CEC scheme exists which is dedicated to aeronautics and *all* its topics of interest.
- Procedures exhibit some “stiffness”.

4. REVIEW OF THE MECHANISMS CONTROLLING THE CONTENT AND CONDUCT OF AERONAUTICS RESEARCH AND TECHNOLOGY IN THE EUROPEAN COMMUNITY

4.1 *Industry Research and Technology—Programme Forms*

Overall strategy for research and technology in industry is the formal responsibility of industry; it has to interact, however, with national Government strategies, particularly on defence matters.

For short-term technology requirements, virtually all the work is carried out within industry, is variously funded by government and industry, and is necessarily based on existing programmes and achievements.

For medium-term technology requirements, product goals and technology goals are established within industry by the process used in the conduct of this EUROMAT Study.¹ This leads to research and technology programmes in industry which are partly funded by industry and partly funded by Government. These industry programmes are usually paralleled by programmes in Government research establishments. Regular, but not frequent, reviews are held in order to maintain a proper relationship between the two forms of programme.

For long-term technology requirements, technology goals are established in general terms as the basis for the research and technology programmes which are largely carried out in research establishments.

All the foregoing industry programmes are the subject of planning, review and resource allocation procedures at Company level on an annual basis. This annual process is supported by an annual strategic examination of future project and facilities needs as part of each Company's business planning.

4.2 *Industry Research and Technology—Programme Funding*

The funding of research and technology programmes in industry follows a three-stage escalating process.

As a first stage, each Company attempts to fund as much as possible of the required programmes from its own resources. The merits of this arrangement are:

- All work is under direct Company control, enabling fast reaction and realignment where necessary.
- Indisputable ownership rights are maintained on developed technology.
- Assessment of resources, and commitment thereof, is positive and clear.

The second stage is initiated by the inevitable limitations in direct Company resources, which then leads to each Company seeking national government funding of part of its overall programme. The effects of this development are:

- All work is still under the control of the Company, but each project must be individually approved by the national contracting authority.
- Ownership and exploitation rights must be shared with national Government departments, and possibly with Government-recommended partners, with attendant legal complexity and effort.
- Prediction and commitment of available resources is less clear.

With the limitations on available national Government funding resources, coupled with the pressure on available specialist manpower due to expanding technology, there is an increasing need to seek co-operation across national frontiers as a basis for sharing the work load; and for obtaining additional funding support. The key features of this third stage are:

¹As indicated in the methodology chart in the Synopsis at the front of the report.

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[Continued

- A proportion of the work in each Company must be under shared control, with approvals as required by the multi-national funding authority, involving more complex bureaucratic and management arrangements.
- Ownership and exploitation rights must be multi-national and multi-partner in form, causing further legal complexity and effort due to distance, and to differences in language and legal systems.
- Both the prediction of available resources and their commitment involve longer timescales.

It is important to recognise that this three-stage escalating process is driven by the special circumstances of the aeronautics industry, namely, the long-term planning and long-term financing necessitated by the extreme length of the product cycle (25 years in total, comprising 5-10 years for a new technology; 5 years for application; and 10 years of production).

4.3 Research Establishments Research and Technology—Programmes Forms and Funding

Overall strategy for the conduct of research and technology in research establishments is determined by the national government concerned, as part of their responsibility for national strategies for industry and for defence.

Based on these strategies, a formal review is undertaken once per year by relevant Government departments to establish the needs of research establishments in terms of short, medium and longer term programmes and objectives. The annual programme of work which is authorised as a result of this process is submitted by the research establishments to industry for discussion, comment and agreed modification.

This industry influence on the programme is sustained not only the annual review process, but also by ongoing informal links between managers and experts of government, research establishments and industry. The aim, from both sides, is to ensure as far as possible that research establishment and industry programmes complement each other, while taking account of the emphasis in research establishments on basic knowledge and understanding of technology, and the emphasis in industry on enabling and applications technology.

Unlike the funding sources and relative funding levels for industry's research and technology work, which are reasonably consistent across seven EUROMART countries, the funding sources and relative funding levels for research establishment research and technology differ substantially. This is due to differences in scale of research establishments' programmes in the various countries, and to differences in policy as to whether or not research establishments act directly as agents of government. The results of these differing features on funding sources and relative funding levels are indicated in Fig. 6-3.

5. NEW OVERALL APPROACH TO CO-OPERATION: THE EUROMART PROPOSAL

5.1 The Need for Common Measures

There is a clear need to take special and urgent action in Europe to counter the threats in the technological field which the EAI now faces and which have been described in the preceding Chapters of this report. For such action to be successful it is submitted that it must be in the form of common measures to tackle commonly-recognised issues, namely:

- The importance of maintaining a "leading-edge" position in all technologies which impact on the performance of the product in the market.

Fig. 6-3 Funding sources and relative funding levels for aeronautics research and technology

FUNDING SOURCE	Research and Technology in INDUSTRY			Research and Technology in RESEARCH ESTABLISHMENTS		
	Industry Budget (Own Funds)	Government Contract	Research Establishment Contract	Industry Contract	Government Contract	Research Establishment Budget (including Govt. Grant)
COUNTRY						
BELGIUM	● ● ●	●	—	—	●	● ● ●
FRANCE	● ● ●	● ● ●	—	●	● ●	● ●
GERMANY	● ● ●	● ● ●	—	●	●	● ● ●
ITALY	● ● ●	● ●	—	—	—	● ● ●
NETHERLANDS	● ● ●	●	●	● ●	●	● ●
SPAIN	● ● ●	● ●	—	●	●	● ● ●
UNITED KINGDOM	● ● ●	● ●	●	●	● ●	● ● ●

Notes: ● ● ● = Major funding, ● ● = Moderate funding, ● = Minor funding

In Italy and Belgium the Research Establishments are at present fairly small

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- The increasing complexity of aeronautics technology, which continues to add many new areas (systems, electronics, software, opto-electronics, etc.) to the still rapidly developing “classic” areas (aerodynamics, structures, materials, etc).
- The increasingly crucial development of advanced design and manufacturing technologies to reduce the cost of the whole range of aeronautics products, which may incorporate varying levels of “on-board” technology. (It should be noted that high technology in manufacture is increasingly necessary to produce a product apparently having relatively low technology “on-board”.)
- The ongoing necessity to match developing technology with developments in other major competitive areas such as product planning, productivity, marketing, product support and product financing.
- the developing necessity to maintain technological competence for the most innovative types of future aircraft projects, as a prerequisite for negotiating a fair and substantial role for the EAI with potential partners outside Europe.
- The increasing discrepancy between the demands of maintaining technological competitiveness and the limitations in national and Company specialist manpower resources, research facilities, and finance.

The cumulative effect of these issues on the EAI’s activities and resources (specialist manpower and facilities, as well as funding) leads to the conclusion that key technological capabilities must in major part be acquired on a joint basis.

As good basis for this joint action already exists in the collaborative programmes which have been built up progressively by the European Companies and which necessarily have to take account of differences in scale, independent capability, accountability to owners, strategic and commercial objectives, and government policies. The level of success achieved in these collaborations, despite the problems involved, is almost unique to the aeronautics industry and provides the essential foundation for even wider co-operation.

The envisaged new overall approach will need to place particular emphasis on harmonised means to meet medium and long-term research and technology requirements. There is also a clear need for these measures to be set against carefully defined goals, in concert with respective government administrations and the EC Commission.

5.2 The need for a New and Overall Approach

This Chapter has described the various existing schemes for co-operative working within the Community which deal with research and technology and involve to varying degrees the European Aeronautics Industry. Although these offer considerable benefits, are appreciated by the EAI, and must be continued, the fact is that none of them exhibits simultaneously all the features which the industry would wish to see, namely:

- To be dedicated to aeronautical research and technology.
- To accommodate the interests of all EC member states with aeronautics industries.
- To give the EAI a leading role in defining and carrying out the programme.
- To improve the co-ordination between the EAI and aeronautical research establishments on a Community-wide basis.
- To provide funding resources additional to those currently available from governments and Companies.
- To establish a single common budget in order to promote enhanced co-ordination of research within the EAI.

In amplification of the points listed above, it will be recalled that many of the existing co-operation schemes cover a range of scientific and engineering activities, not only aeronautics. A Europe-wide aeronautics research and technology programme is judged to be of sufficient size and importance to justify its own dedicated policy and management structure. On the matter of national participation, a number of the present schemes involve nations outside the European Community, others involve some but not all EC countries. There are cogent reasons, notably in regard to commonality of interest—and, not least, funding—why participation in the new initiative should be restricted to EC countries, but importantly it should include *all* EC Member States. In those States without an aeronautics industry it will be possible for Universities and other research establishments to make a valuable input to the activity. Concerning the role of the EAI, it is perhaps self-evident that industry must play a major part in defining and carrying out the programme for it is they who ultimately have to exploit the results in the market-place. However, equally important is the proposed Europe-wide nature of the industrial involvement. The EUROMART study has involved the EC Commission and nine Companies from seven European nations, demonstrating not only the practicality of co-operating in this context and at this level, but also the willingness and determination to do so effectively for the common good.

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As regards involvement of aeronautical research establishments, in order to maximize the skills and expertise available the co-operation between these establishments and industry must be strengthened. Co-operation at present is often either of an industry-establishment form on a national basis, or establishment-establishment form on an international basis.

Finally, on funding, for the European Aeronautics Industry to have a reasonable prospect of success, the present level of expenditure on research and technology needs to be raised significantly. An essential concomitant of this is to eliminate duplicated efforts, and create a single, co-ordinated, comprehensive and prioritized work programme (rather than try to adapt the present piecemeal arrangements) and to underwrite this programme with a single, unified budget.

5.3 Structure and Management

The work carried out over the past two years in preparing the EUROMART proposals has established a pattern for the European Aeronautics Industry and the EC Commission to work effectively together. Clearly, in the future management of such a project, national Governments and Establishments together with Universities and similar institutions will also need to become involved.

The main features of the EUROMART recommendation for a new co-operation scheme are shown in Fig. 6-4. At the first level of involvement comes the legislative process to set the organisation in place. This will clearly rest with the Council of the European Community and the European Parliament in conjunction with the Member States. Overall policy would be initiated within the Commission through the appropriate Directorates, predominantly the DGXII Directorate for Science, Research and Development.

The next level is concerned with actual management of the co-operation. As public money would be involved, it is necessary that the Governments and the Commission be the ultimate decision-makers in this process. However, such decisions should be prepared by preliminary work (particularly on the technical contents of the projects and their inter-relationships, the desirable balance between their different items, the intellectual property provisions, etc.) taking fully into account the views of all the involved participants. This should be achieved through appropriate bodies drawn from Governments, Establishments, Universities and industry, with industry taking a leading role, as already advocated.

The last level is that of implementation, which involves individual project teams (shown numbered, at the bottom of the Figure). Again, these should be largely industry-driven with participation from the Establishments and Universities.

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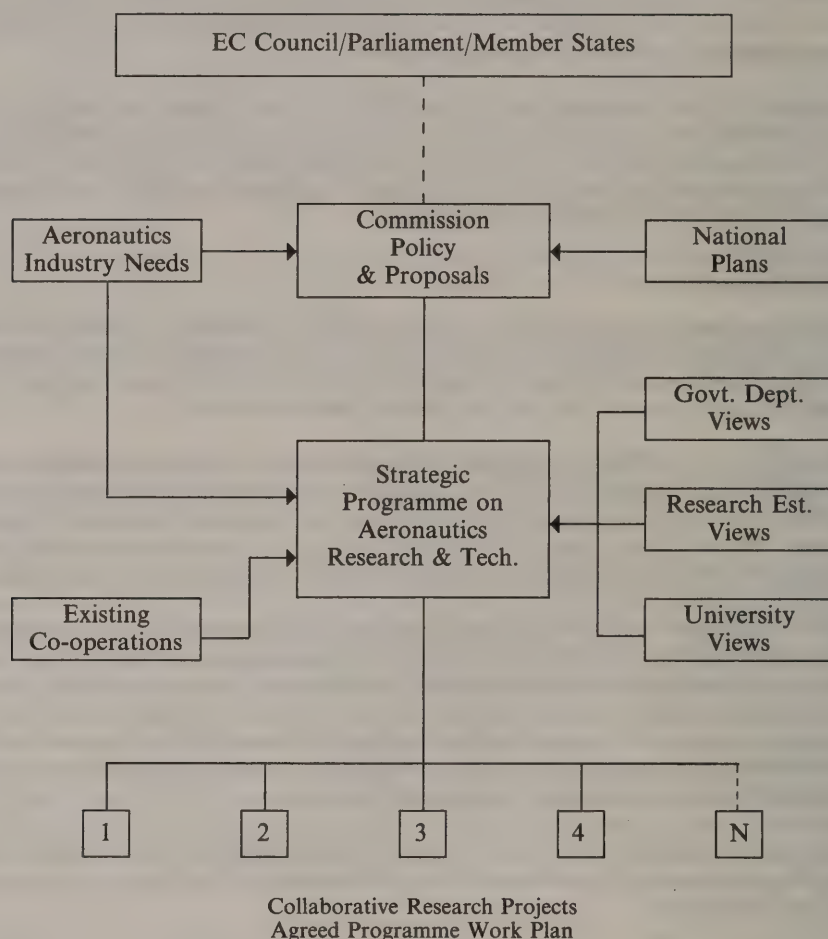


Fig. 6-4 Main features of the EUROMART recommendation for a new co-operation scheme

It is envisaged that the body charged with management of the overall programme will be responsible for:

- Preparation of detailed programmes with costs and timescales.
- Preparation of budgets for submission to EC funding authorities.
- Management of funds provided by the EC and their allocation to projects.
- Monitoring of performance (expenditure on, and achievement of, individual projects).
- Reporting of progress and achievement.

6. CONCLUDING REMARKS

It is considered that there is a need to develop a new form of co-operation, a scheme taking into account the features listed in Sect. 5.2 of this Chapter. Because of the Community scope of this new initiative, it is proposed that the Commission plays an important role in its development.

It would be neither necessary nor appropriate for the proposed new scheme of co-operation to compete with or displace existing national and co-operative research activities. It should be seen, rather, as a major reinforcement of, and complementary to, existing co-operative arrangements. It would nevertheless be necessary to take measures to ensure a close and harmonious relationship between the new and the established activities.

This proposed new scheme of research co-operation, established in a Community framework and under management arrangements taking full account of the interests of governments and of the EAI, is seen as an important and necessary means for providing the infrastructure for the common research and technology measures proposed in the report.

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Examination of Witnesses

MR J ARNALL, Head of R and D, Headquarters, MR R COLE, Controller Research, Headquarters, and DR J STARK, Executive, Science and Earth Observation, Space Systems, British Aerospace plc, called in and examined.

Chairman

820. Mr Arnall, we are grateful to you and your colleagues for coming to give evidence to us this afternoon. We are grateful also for the paper that you have submitted to us, which we have read with great interest. We have taken note of the evidence that you gave to the Select Committee on the European Communities in looking at the framework programme. Would you first like to introduce yourselves and make any preliminary statement that you would like?

(*Mr Arnall*) Perhaps I may start, my Lord Chairman, by saying that I was in fact the architect of the written evidence that was put in to you. It was in fact sent by Mr Ivor Yates, who at that time was the Deputy Chief Executive (Engineering) at British Aerospace. Since then, in July, he has retired from the company. We thought it sensible in order to provide some continuity that I came along, accepting your invitation to give evidence. In putting together the written contribution I was greatly helped by my two colleagues here. Mr Cole works with me in the headquarters of British Aerospace and is particularly responsible for our relationship in collaborative matters, particularly Europe and particularly the European Commission. Then from one of our operating companies, because although in the main our response we addressed technology (rather than science or big science as such) our space company has a close affinity with space science and so a specific contribution was made from our space company through Dr Stark. I am therefore going to rely on both those gentlemen when it comes to questions about the European situation in collaboration or space. As far as any introduction in general terms is concerned I should briefly reiterate the main point we tried to make in our written submission. It was that collaboration as we see it is important, certainly it is increasing as far as the aerospace industry is concerned. We think it is important that one sees it as a whole as, in a strategic sense, part of one's overall approach to the acquisition of technology. It is not something that we would in any way suggest is dealt with on a piecemeal basis but rather as part of an integrated picture of technology acquisition. In so far as we could be of any help to the Committee we thought we could perhaps give evidence in that sort of area of our experience and how we go about doing it. My Lord Chairman, that is all I want to say in introduction in general.

821. Thank you, Mr Arnall. You have mentioned the strategic area. In the memorandum in fact you say that "international programmes should be developed as part of the process of achieving strategic UK goals in science and technology". How do you discover what the strategic UK goals are?

(*Mr Arnall*) That is a well nigh impossible question, I think, from the very top! I should prefer

to edge my way up to it, I think, my Lord Chairman. From a company point of view in a way I think you could argue that one or two of the largest companies in this country almost represent the strategic interests of the country in that area if they are sufficiently large. Rolls-Royce in essence must represent most of our strategic interest in aero engines, for instance, so I think that the companies have a role to play in establishing what they are about in their various technology areas for a start. One step up from that, clearly the trade associations have a role to play, I think. One could look to the trade associations in areas of industry to try to establish a view and to try to establish a direction for technological development and the role that international collaboration would play. I would quote here particularly the SBAC, which is increasingly trying to establish some set of goals for aerospace; to promote these and get these agreed by the various members of the SBAC. As to other contacts, the Government clearly has a role to play through the DTI. One sees quite a lot of activity by the DTI in trying to establish goals in certain areas. On the academic side, perhaps we have less direct experience, but again obviously one would look to the research councils particularly, as far as we are concerned perhaps, to SERC, and hope that their approach to science and the acquisition of technology is on a strategic basis, and I think that we do see signs of that. There is no single universal answer, I think, my Lord Chairman, that we would see or even recommend, but we would suggest that the basic approach should be addressed at least in several areas as appropriate to specific sectors of technology.

822. I find it rather difficult to understand exactly what you are after, Mr Arnall. People talk about things being technology driven or market driven. If you say, what should the role of research and development be in the field in which you operate, I do not have a very clear idea in my mind what you are talking about. Are you just talking about the fact that we should have a larger market share than anybody else or that we should be able to say what is wanted 20 years ahead or are you saying that more government support should be given to that which is often rather vaguely defined as precompetitive research? I am not quite sure what you are really aiming at—what is this goal, what sort of thing is this goal?

(*Mr Arnall*) Perhaps we could quote some examples in the aerospace sector. In an international context—here perhaps we would focus in the first place on the European situation—our first strategic concern I think would be simply the level of investment in aerospace technologies which are being made throughout Europe.

823. In developing new technologies?

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[Continued

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(*Mr Arnall*) Yes, in developing new technologies, and the ability to withstand the competitive threat initially from the States and perhaps in the long term from Japan. I think there is that question, one of resource in a European framework. To come down a level from that, there are questions about the types of technology, whether this is very basic research or applied research and, particularly important to aerospace, whether we have a significant programme of technology really to demonstrate that these technologies are properly preparing us to get the products into the market with the appropriate performance and so on. Therefore, my Lord Chairman, I think that we would be concerned about the balance of the programme in the spectrum of basic research through to technology demonstration. Then, on particular technologies, yes, we would have a view in trying to identify what some of the key technologies are which will be important ten, 15 years ahead.

Lord Nelson of Stafford

824. Is not the space programme an important element here for one to look at? Can you visualise this country having a space programme on its own? Is not the European space programme really essential to the maintenance of a space programme in this country?

(*Mr Arnall*) I should first make the general point, I think, that in aerospace as a whole we are very much linked with and wedded into Europe generally, aircraft and space. I think that that is true of the industry. In regard to space, I should like if I may to ask my colleague, Dr Stark, to comment.

(*Dr Stark*) The level of expenditure required in the space area certainly means that it is very difficult to make substantial strides in technology without taking a significant part of the activity within, for example, the European Space Agency. It is very difficult with the present cost of developing space systems to see how you can have a significant programme in the United Kingdom on its own. That does not mean to say that one should not have a United Kingdom programme as well.

825. Oh, yes, but without it you would not be getting anywhere?

(*Dr Stark*) Yes.

826. If I may take that point and go on from there, what is your view about the set-up of the European Space Agency? Do you think that it is an effective one or would you rather see it done differently as a European collaborative programme?

(*Dr Stark*) It works very effectively at building up the overall level of expertise in Europe, comparing that with what is happening within the United States and within Japan. As an organisation it still spends only a fraction of what is spent in the United States. The level of expenditure obviously has to be matched with the goals and aspirations of that programme. By that I mean that one maybe should

not think of the European Space Agency as being a competitive agency to the US agencies purely on the basis of the level of spending. As to its effectiveness, if we look back over the last 20 years of operating the European Space Agency, I think that the agency has a lot to demonstrate of value in space, so on the basis of what the agency has brought forward I think that we ought to consider this.

827. How are the decisions arrived at as to what the level of effort should be?

(*Dr Stark*) Over the programme, you mean?

828. You say that we are underfunded as compared with the United States and Japan.

(*Dr Stark*) Obviously they are political decisions.

829. Where? You do not know?

(*Dr Stark*) Well . . .

Chairman

830. We have done a study on space, of course, and we were interested when we were in Paris the other day and in Bonn to find that both had considerable reservations as to where it was leading them. However, to get back to the question, what you are really talking about as a goal is some way of a combination of industry and government working together towards your goals? You have said in regard to the European framework programme in your submission that you suggest its emphasis should be changed a bit more towards your field, and that it should be expanded. However, I do not quite understand what you think the European framework programme can do which direct collaboration between the aerospace companies of Europe itself could not do. What is it that the European framework programme gives you that you could not do by co-operation within the aerospace firms and organisations in Europe?

(*Mr Cole*) The starting point on this, my Lord Chairman, is, as you say, that you can have collaboration between companies and, indeed, for over 30 years we have had extensive collaboration on Aerospace products. There are some major examples of which you are fully aware of the results of that collaboration in terms of aircraft in service. We have identified a need over the last ten years to move into a similar level of technology collaboration; this is different from product collaboration because product collaboration tends to be the sectioning of a shared product with no substantial transfer of technology across the national boundaries taking place. Our moves towards this new situation, my Lord Chairman, were driven by the lack of resources that we can command individually as a company or as a nation to acquire the technology which we need to stay competitive in an expanding field, so we are driven towards collaboration. We then arrive at the point of your question, why should one not do that on the same basis as we do for product

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collaboration. A main reason for that, if you will bear with me, my Lord Chairman, is that in the aerospace field, particularly in aeronautics, we believe that we are unique in the product cycle length that we have to accommodate. We have to use something like a 25-year product cycle length, five to ten years of technology acquisition, five years or so of design development to apply the technology to a new product, then about 10 years of production. In that environment, which demands long-term planning and commitment of scarce resources, we have to have something to drive complex collaboration, something more than the normal pressures we can command within an individual company or country. As we mentioned in some of the previous evidence, I think, a number of the collaborative actions which have been set up started between the companies but rapidly expanded into necessarily involving governments. Turning now to the European Framework Programme, if one says, what advantages does the Commission have over the normal inter-company or inter-government collaboration, it has to be said that it is unique not in any one thing but in a combination of things. Firstly, it can be a central forum where, although sometimes with great difficulty, it is possible to get a common political will accepted across all the various participants in the member states of the Community. Secondly, it is probably the only means that most European countries and companies would accept of being able to launch international action while still respecting national programmes. That is important because it is seen by most authorities that the Community and the Commission in the Framework Programme should not substitute for national programmes, but complement to them. Thirdly, and some people say most importantly, it has at its command a central budget, and the ability to use the central budget to drive collaboration is a pretty vital factor in our view. On programmes like the Eureka technology collaboration programme, for example, we have tried to get projects launched that necessarily have to have the common support of about six member governments and six member industries; we have tried to get that at the same time and the same level with an equitable arrangement from them, which is a very difficult process. Having a centralised budget, therefore, is very good. The last thing I would mention is that the Commission has an established organisation for international co-operation. I emphasise that in all those things it is not paramount in any one, but it is unique in having the combination in our view. That is the basis of why we look upon the framework programme as being a vital means to European technology collaboration, my Lord Chairman.

831. We got a rather different view when we were in Cologne the other day with DLR. Professor Kroll took the view that the trouble with the framework programme was that you got good co-operation with people who really knew their business and were skilled and good at it diluted by

being mixed up with different aims of the people with whom one was merely forced to collaborate for the sake of collaborating with somebody else. He said what was really needed was to make sure that one made use of the best facilities available from all those who had the facilities and were good at it. You do not take that view?

(*Mr Cole*) We accept that that is a major factor in the situation. It is our view that there is a price that one has to pay for wide ranging co-operation. It would be delightful if we were able to use a Community-type programme and limit the collaboration to the optimum efficiency level, which is three to five organisations of roughly comparable size and efficiency and knowledge who are well acquainted with each other. That is the most efficient way of getting fully effective collaboration. However in the Community environment, the 12 member states need to be satisfied that they are receiving some benefit from the joint endeavours. Therefore, one has to accept in our view that there is an imperative to show involvement at various levels of the smaller member states and small institutions and small companies. That again, I would add, is not entirely negative; our recent activities in this field, particularly on the Aeronautic programme now in its second year, have shown us that it is possible to work effectively in such wide ranging co-operation. Although it is initially less efficient, we can drive towards an arrangement that is acceptable in efficiency and management and has the added benefit that it extends the interface we had previously to other fields of expertise which, although they may be smaller or less direct, are often shown to be of high value.

832. You take part in the European framework programmes yourself?

(*Mr Cole*) Yes, my Lord Chairman.

833. And you think that it is going to make you a more efficient company in the end?

(*Mr Cole*) We apply—I am not sure what the principle is—the principle of maximum return for least effort perhaps. We would prefer from a philosophical point of view (obviously any company would) to do our research and technology within our own funding and under our own management. It is straightforward, it is easy, you can control it; it is an ideal situation. However, one is forced away from that by the lack of resources, that is, money, men and facilities, to participate in a national programme with all the attendant increase in complexity and in management and legal problems, particularly in respect of exploitation rights. If that is inadequate, and that is the position in which we believe we find ourselves, then we have to go international and use Europe as the prime base in order to get the breadth and scope of technology acquisition that we need. That is the third step that we are forced to take, which again brings attendant problem of international legal complexities, differences in language, location and so on, with which you are very familiar,

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my Lord Chairman. Therefore, we do not go into European collaboration as an easy choice. We go that way because we see it to be the only pragmatic way progressively to make ourselves competitive, as Mr Arnall was saying, over the next 25 years.

(Mr Arnall) It is really a considerable management burden, my Lord Chairman. If you are going into this collaborative business on a wider and wider basis from the United Kingdom, then into Europe, you simply have to face up to the fact that it is a major management burden but it is a price that we are willing to pay because we have got to.

Lord Sherfield

834. Do you keep permanent representation in Brussels and in Paris?

(Mr Cole) It depends what you mean by permanent.

835. Do you have offices there?

(Mr Cole) Not at the moment. We have the intention to have an office in Brussels. However, we have a more or less permanent representation in the sense of involvement of senior people with the activities in Brussels and Paris on civil and military fronts.

(Mr Arnall) Mr Cole himself spends one or two days a week over there.

Chairman

836. I still do not really understand why you think the European framework programme and that machinery will produce better results for you. Of course you have to collaborate in production and collaborate in design now; the European aerospace industry must be a collaborative industry. However, I do not understand why in respect of R and D and the development of new technologies you have to do it through the bureaucracy of the European Commission. You do not do your other collaboration through the bureaucracy of the European Commission other than within, as it were, the aerospace industry in Europe itself. Where are you getting these bits of technology from you cannot get out of your own resources? You are getting them from other sources?

(Mr Arnall) But we do have a series of bilateral arrangements. However, the co-operation field is complex and operates in a whole spectrum from bilateral arrangements to industrial club arrangements through to the Commission. There is no unique answer, my Lord Chairman. I am not at all sure that the Commission arrangements are over-bureaucratic. We are quite pleased with the way they operate. Perhaps Mr Cole can add something here.

(Mr Cole) I would endorse that. It is the spectrum that we have to look at. It can be seen as a number of layers. The first is company funded in-house technology, which we keep in-house for deliberate reasons because of what we refer to in the note as the

"family jewels". The next layer is the balance of the wholly company funded activity. Then comes the layer of national collaboration. Then comes a final layer of international collaboration. This is a layer cake that we build up to achieve the totality of the company programme. With regard to the bureaucracy of the European Commission, it is true to say though it is a complex system, as one gradually progresses through the procedural machinery, one gets to know how it works, and working the system in Brussels becomes no more difficult than working the system in a national bureaucracy. In fact, the Commission have a more "hands off" attitude in some respects. Having agreed that there is a proper programme that should be supported for adequate reasons, first, they have the confidence to allow the participants to carry it out and secondly, of course, the size of the Commission is still relatively small and therefore they do not have large numbers of experts available to supervise it. Our experience of the comparison between Framework Programme supervision and national government department programme supervision therefore is that they are comparable and there are some positive advantages from the Commission side.

Lord Porter of Luddenham

837. You seem to have said something a little different now from what you said earlier. Mr Arnall was speaking of the added problems there are so that you have to go on to the international scale. You were just saying now: well, no, the problem is about the same on the international scale as it is on the national scale?

(Mr Cole) I am sorry, we did not distinguish properly between two features, for which we apologise. There are no major additional problems in dealing with the necessary bureaucracy interface to set up the programmes and, because there are public funds usually involved, to monitor them. But there are additional problems of complexity and cost associated with the actual management, development and utilisation of the project itself, trying to run a technological project in six or seven countries with universities, industry and research establishments involved; this is necessarily a time-consuming, expensive and complicated business.

838. What are the advantages of going into the framework programme? Are there financial advantages?

(Mr Cole) Yes and no. The advantages are quite simply that it brings us to a position where we can access and exploit a wide range of specialist manpower and facilities at a much higher level than we can command either as an industry or even as a nation.

839. This is what you call technological acquisition?

(Mr Cole) Yes. The disadvantages are that it is more expensive because of the increased complexity

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and activity. On the other hand the gearing is such such that the return on investment is higher because we are accessing such a wide range of people to do it. If we have one unit of investment in a programme with six collaborators nominally you have a gearing of seven on return. Even though our costs may be twice as much, we are still getting a return of three and a half times our investment. I repeat, if we could acquire all the technology we need as an industry or as a nation it would be an easier process, but wider European collaboration is the only way we can see to meet our objectives.

Chairman

840. In your dealings with Brussels on the projects for the framework programme have you found difficulty in agreeing whether or not it is precompetitive research?

(*Mr Cole*) There is inevitably a grey area in this. It depends not only on the technology but on the timing. Most of the effort which is now going on in the Framework Programme in biological and bioengineering type research, would be accepted as precompetitive, purely because it is a relatively new subject in the industrial field anyway. There is therefore an openness on the part of industry to collaborate. In some of the automotive fields research work is getting quite near the product and it is more difficult because it is a product development rather than precompetitive. However, on a case by case basis, we have found it possible to arrive at what is hoped to be a sensible judgment as to what is precompetitive and what is not precompetitive. As you know, the latest Framework Programme incorporates a move to drive towards major technology demonstrators. This again is nearer the product than some of the previous types of activities that were much more upstream towards the precompetitive end.

841. Have you found difficulty protecting the property rights of your crown jewels in it?

(*Mr Cole*) The gearing issue here is that one of the prices to pay for wider collaboration is a reduction, quite a substantial reduction, in what are seen as crown jewels which must not go outside the company door. Only ten years ago some of our companies might have looked typically look on 50 per cent of their programme as being that. This level has to be substantially reduced in some areas. That said, the protection of IPR, Crown Jewels or not, can cause difficulties. On the other hand, with the IPR arrangements that have been developed within the Commission are becoming accepted as being reasonably fair and reasonably workable. That is not to say that there are not problems and that is not to say that there will not be aberrations, but in general terms they are seen as something that can be lived with.

842. In the memorandum you say you think that the existing framework budget "is far from

generous, and may well be inadequate". It is suggested there is a bias towards information technology. But surely we are beginning here to come up against the principle of subsidiarity. Is there not a danger that if you encourage the framework programme too much it goes beyond the principle of only taking on what is best done through the Community and it just becomes a pot of gold for anybody who can get some money out of it instead of spending it themselves?

(*Mr Cole*) That is clearly a perceived danger, my Lord Chairman. Let us say first from our side that we totally support the principle of subsidiarity. By what I was saying earlier, we only wish to enter into international or national collaboration on a basis of essential needs. Secondly, may I address the last point. We believe that a central funding that comes from outside the industry is crucial. It is more to do with it being used as a driving force to enable us to set up collaboration effectively than it is to do with the mere acquisition of extra funding. It is a means to an end, not just an end of getting extra funding. Our primary objective is the increased collaboration that we see to be necessary to gain the technology that we think we need. As to the relative scale of the budget for the Framework Programme we believe that it is surprisingly small. For instance, the current "Framework 4" Programme is only about three point something per cent of the total Community budget. It is also only 3 per cent roughly of the total research and technology development budget from official sources in all the 12 Member States. Equally surprising to some of us when we first heard it, it is less than one tenth of what Germany spends on research and technology development. Therefore, we do not believe that there is much danger of its being an overwhelming force. We think that it is relatively small, and could readily be enlarged and still perform the purpose that we were seeking of it, namely a drive towards more efficient collaboration.

843. We have talked so far almost exclusively about Europe. Can you say something about collaboration first with the United States and then with Japan? What are the problems of doing this?

(*Mr Arnall*) I would not wish to suggest that there is any exclusivity about this. The art of collaboration is to operate a horses for courses policy and be aware of what you are trying to get out of it. But it would be fair to say that I think our collaboration is more developed in the European situation than in the States or in Japan. In the States we have a very successful record of collaboration on products. Military aircraft, the Harrier and Hawk and a number of other projects, have been very successful, but it is rather more difficult in the key technology areas. America tends to be a little sheltering of its technologies. While we would have nothing against us in collaboration in principle, in practice we find it that much more difficult. I think it is in our interest that Europe be stronger in a strategic sense and that we play our part in Europe in that respect, but not

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and Dr J Stark

[Continued]

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on an exclusive basis. I think those comments about America equally apply to Japan but probably in a less developed form.

Lord Nelson of Stafford

844. In that international context I am not very clear. You are the major activity of the country in aerospace. Where does the decision-making lie? There are projects company to company which presumably you pay for, and the lie within the ambit of British Aerospace. Then there is co-operation on joint projects that are government funded, possibly through you—I do not know. Then there are strictly international collaborations on advanced science which may be funded I do not know where—the DTI, the Ministry of Defence, SERC or wherever. Can you say where the decision-making lies here?

(*Mr Arnall*) When you say projects are you distinguishing between the products, like aeroplanes, missiles, as opposed to technology projects?

845. International collaboration of all sorts?

(*Mr Arnall*) I think that I should first like to focus on the research and technology side. Within the company we try to establish some form of strategic framework and approach to the business of acquisition of technology. There are of course within that relationships with government departments at a high level. One sees various ministries, the DTI, the Ministry of Defence, having collaborative mechanisms in place. We would in fact relate to those and try to have some form of harmony of strategy with them if possible. When we have established the basic framework guidelines and approach, when it comes to individual items of the programme very much within British Aerospace, the decisions are taken in our business units. It is their job to acquire and exploit that technology. They have to be persuaded in the end and have to convince themselves that it represents a sensible deal as a piece of collaboration and that they are getting more out than they put in and it fits into their particular local interest. We would encourage them to do it and arrange that the external circumstances are favourable for it to happen. At the end of the day, however, the final decision process on any one individual programme of work rests with our companies.

846. Even though it is being paid for by some other source?

(*Mr Arnall*) These days the degree of external subsidy or support is relatively modest, less than 50 per cent, sometimes down to 10 per cent, so they have to face up to making a significant investment from their own funds within the context of their own business.

Chairman

847. Mr Arnall, it was suggested to us the other day that one of the fields of great importance well within subsidiarity for the European framework

programme was research as a basis for setting standards and norms and that there was a danger that too much concentration on establishing European standards would militate against having access to the America market and so there was something to be said for putting effort into ensuring European standards fit American standards; and, therefore, there was something to be said for associating Americans or Japanese with certain European framework programmes. We got a very sharp reaction against that when we were in Paris last week when it was suggested: for God's sake do not do that or we will have the Japanese flooding the European market! What is your view of it?

(*Mr Arnall*) First of all, my Lord Chairman, standards are important. Secondly, the European institutions have a significant role to play to look after European interests. From the aerospace point of view I think one would look to AECMA and the European trade association for the aerospace industry to have a particular interest there. Then one would look to Commission programmes, that is, research programmes, to help support that interest. I really do not believe that Europe, perhaps in this case through AECMA, could in any way go it alone without the closest contact with the Americans. I am sure that most of the AECMA activities are being promoted on the basis of trying to establish a world standard. In fact, my immediate boss spent only last week in the States on that very subject trying to harmonise European aerospace standards with those from the States, so we would take a positive approach to that harmonisation.

(*Mr Cole*) One of the major conflicts, if I may add a small point on that—and I find the remarks made to you a little surprising—on standards in Europe and the United States is the use of the metric system to replace what is still termed the Imperial system. In aerospace at least the tendency of the Americans to go towards the metric system now seems to be irreversible. To delay a European issue on the basis of something that the Americans are now almost convinced to change seems a rather strange approach. As Mr Arnall said, we would seek harmonisation but we would not think in Europe we are in any in a weak position in that; if anything, it might be argued that we are in a stronger position than the United States.

848. As more and more businesses are international does that complicate taking part in European collaboration?

(*Mr Cole*) In what sense?

849. I mean in taking part in the European framework programme. If you are an international company operating within Europe, does that raise problems?

(*Mr Cole*) Within Europe as such, very little. In the case of European conglomerate there is no real problem because it is just the constituent parts who will participate. There are problems when major

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and DR J STARK[Continued

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companies that are intercontinental but have a strong European presence want to join in framework programmes.

850. Nissan UK take part in the European programme—

(*Mr Cole*) Nissan, or for instance IBM. The criterion—and again it is one in which there need to be some more examples in order to set a reasonable standard—is that such companies should have a substantial research presence within Europe and

therefore that this European operation can be counted effectively as a European company. In passing, my Lord Chairman, as I am sure you are aware, there are special arrangements with the European Free Trade Association countries where they are fully open to participate in Framework Programmes but their member government then has to provide the support that would normally be supplied by the Commission.

Chairman] Thank you very much for your help. We are most grateful to you.

MINUTES OF EVIDENCE
TAKEN BEFORE THE

SELECT COMMITTEE ON SCIENCE
AND TECHNOLOGY
(SUB-COMMITTEE II)

Thursday 17 January 1991

EUROPEAN COMMISSION

Professor P M Fasella

Professor J A McCleverty

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THURSDAY 17 JANUARY 1991

Present:

Adrian, L
Dainton, L (Chairman)
Kirkwood, L
Nelson of Stafford, L

Porter of Luddenham, L
Sherfield, L
Taylor of Blackburn, L

Examination of witness

PROFESSOR P M FASELLA, Director General, Directorate-General XII, Commission of the European Communities, called in and examined.

Chairman

851. Thank you very much indeed, professor Fasella, for coming to see us today and particularly at this critical time. We are very appreciative of your efforts and also very grateful for that most helpful paper which you produced last August which has been very useful to us. Now, you have, I think, had a list of our questions beforehand so that you know something of the ground we wish to traverse, but it is, of course, open to any member of this Committee to put any other questions which he or she should deem to be relevant. I wonder, with that background, whether there is anything you would like to say by way of a general statement before we begin?

A. Noble Chairman and noble Lords, I am very grateful and honoured to be here. On the previous occasions I have always been very stimulated, so I appreciate this very much. On the basis of the items which your Clerk very kindly communicated to me, there may be three general points which can be referred to out of the 11 questions about which you are greatly concerned, and I should say so are we. One is the whole problem of evaluation and how independent evaluation can be and is actually used to improve the system. Another is the problem of which type of contract is most suited for the universities to make the best of their participation in our Community programmes. The first question, which was of a more general nature, is what is the impact which the United Kingdom has on Community programmes, especially at the time when they are conceived? With your permission, I would make three short general remarks on these points. Concerning your first point—what is the impact of the United Kingdom?—I would distinguish the impact which is institutional from that of a more informal nature. There are a number of committees which are established by the Council and Parliament where all Member States have the right and duty to participate and here the United Kingdom participates like other Member States and the weight of its impact depends upon how convincing its arguments are. Obviously this input is inevitably more of a political nature. But then—and I mention this because it is less known and it is another form of impact where for a number of reasons the United Kingdom has perhaps had a larger influence than, I would say, have other countries—there is the direct impact which either individual scientists or researchers in industry or users of research results or non-governmental

institutions—the Royal Society or the learned societies—have on our programmes. Without boring you with the details (but they are all available, including the names and addresses of these various individuals and bodies) I shall just say that they represent to the Commission a most valuable way of having direct opinions and advice from the persons who actually carry out research or actually use the research results. We do this sometimes through personal contacts, sometimes by asking a body or institution to carry out a specific study. Therefore, there is no distribution by nationality, we go to find the experience where we think it is most valuable, and we check with others generally before giving an important task of advice to a specific person or institution. We would ask the Max Planck Institute or a body like the European Science Foundation about particular persons the Royal Society might suggest. You understand that this is not because of mistrust but to have persons in whom others have confidence. For historical reasons it just happens that the United Kingdom generally participates more. This comes naturally, it is not planned. We look around and that is what happens. I mention this because it is not published but if your Lordships or your Clerk are interested, we would provide data that shows this. This is the first general point.

The second general point is evaluation. Evaluation is a rather new science. We may not want to call it that. It is a tool we have been applying progressively and more and more vigorously over the last decade. There is still a lot to be done and we now speak of independent evaluation carried out by persons who are knowledgeable or potential users of the results of research but have not been directly involved in the programmes. Evaluation is now part of the system and the Member States and Parliament do not approve a new programme unless the programme—and I speak of research programmes—specifies the terms against which the evaluation will be carried out. There will be no renewal of the programme unless this result is provided. We have evaluation of the Framework Programme which, as you know, is the overall planning instrument, and then of specific programmes. The Framework Programme is a rolling one. It is of five years duration. Every third year, it is reviewed by an independent panel and a proposal is made for a new overlapping framework programme, so that the first two years of the next programme correspond to the last two of the previous one. This has been decided in order to combine flexibility with some continuity.

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[Continued]

[Chairman Contd]

Activity on each programme has a peak, I would say, around the third year, then goes down a little, at which time the next one is coming up. So it is difficult, unless you understand this system, to answer the question, is it a midterm or is it an end of term evaluation? Because when the third year comes you will have completed the previous programme while you are halfway through the current one. It may sound complicated but it proves efficient; since five years is quite a long period, it is good to know even for the running programme if you have to change or stop something.

852. So it is possible to change years 4 and 5 of the first tranche at that point at the end of three years?

A. Yes. I have noticed that one of the remarks sometimes made is that evaluations are done rather rapidly, but they have to be done quickly or the data become obsolete. The same principle applies to each specific programme which is looked at in depth. So you have an evaluation of the overall system.

853. As I understand it, there are eight years involved here, five and five but with two years overlapping with the end of one, and so on. When you are in fact evaluating at the end of the third year of the first programme, it influences what is going to be done in years 4 and 5 of that and may also be an element in shaping the next few years of the second programme?

A. Correct. That is even more important. Then it is important to know that each programme is also evaluated separately so that you have both an overall view and —

854. At the end of five years?

A. Yes—I am being very Italian in using my hands. Each programme is also evaluated by itself. The other point you raise is, how are the suggestions from evaluation used? They have a great impact. If you take the results of the evaluation reports for the overall Framework Programme, they have come out with suggestions that go way beyond the Commission's services and actually recommend a change in the Treaty. The present system, as specified in Title VI of the Treaty of Rome, which concerns research, was introduced with the Single Act and it foresees that the Framework Programme is first proposed and discussed and this could go back and forth between Parliament and Council twice. It takes us some time, even when all goes well. Then you start proposing the specific programmes which also go back and forth between Parliament and the Council four times—well, twice each way. This can make the whole procedure incredibly long. I myself reached public administration rather late in life. I have had experience with industrial research and I do not know any working industrial system that requires three years to get things approved in research. I think the Commission is fully persuaded of the need for change and even at the last meeting of the Summit of the European Community Member

States this was listed among the items that should be looked into in case a new Treaty is prepared (I understand this is not so important as other matters, but certainly for research it is and I dare to bring it to the attention of your Lordships because of its political implications).¹

Evaluation also gives rise to many suggestions which are operational. They are very useful. Evaluation, to be effective, must be hard on those who are evaluated; provided one is not killed or badly maimed, one behaves better if you know you are to be evaluated. Steps are taken continuously to try and improve the system and to make better choices. There are many examples. First we had materials and industrial technologies as two separate programmes and, as the evaluation indicated, this was not satisfactory. We fought a bit of a battle with persons that like a large number of committees, as they wanted to keep the programmes separate, but eventually we persuaded everybody to have a single programme.

In many programmes, scientific items have been dropped, because evaluation showed they were obsolete or better done elsewhere. Evaluation also provides many suggestions for improving our administration. We generally have to show to Member States and Parliament, when we propose a new programme, how we have complied with the recommendations of the evaluation panels. It will take too long to tell you all this now, but this material is available.

There is a third point, which that of the contracts for universities. As of now the universities have a choice. I oversimplify things a little bit and I apologise for that. The first choice is that they have reimbursement based on the total cost of the project. When this has been established, and we know exactly how much a project costs, the Commission reimburses a part of it. We generally reimburse 50 per cent. On very special occasions we can decide to give more or less. We give more than 50 per cent when the results are really needed for some Community problems. This happens sometimes in what we call pre-normative research, where the Commission wants to buy the knowledge because it needs it as a basis for preparing new norms. We may then pay more than 50 per cent. On the other hand we may pay less, though remaining in what we call the pre-competitive phase, if the research gets closer to the market; then industry should pay more.

¹ *Note by the witness:* The principal difficulty with the current procedures for approving the Framework Programme and the specific programmes which implement the Framework Programme stems from the different levels of involvement of the European Parliament required for the legislative decisions. For the adoption of the Framework Programme, the Parliament is consulted whereas for the adoption of the specific programmes, the "co-operation procedure" is used. This difference in the procedures used can lead to delays in approving the specific programmes. The Commission would like to see this anomaly rectified in forthcoming discussions on Treaty reform.

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Lord Taylor of Blackburn

855. Could you give us an example of what those two would be?

A. Those for which we pay less than 50 per cent?

856. When you pay more?

A. Take a programme in biology applied to agriculture. If there is a very fundamental research phase we may pay more than 50 per cent. Then there may be an applied research phase where we pay 50 per cent. If then you have good results and some agro-industrial concern wishes to try out, for instance, genetically modified plants on the field, that becomes more expensive. It is closer to the market. If it is a five year programme we might still pay 50 per cent for the first year, and then industry and the private sector should take over. This is a hypothetical case and it is different in various fields. For most projects we pay 50 per cent. We think it is essentially a good system, especially when we work with industry. It is, as a rule of thumb, the most effective way of making certain that the industry which carried out the research will be motivated in exploiting it, because they put in their own money. As an example of advice from an evaluation panel, which we implemented in the next programme, the evaluation panel said in this connection that we had to insist that industrial research contracts with us be signed by somebody high in the companies, perhaps the Chairman, but not only by the head of research, because then the company become responsible for the money. This works quite well with industry, but it does create problems—and this is one of the points at issue—with universities. Many universities do not have a detailed accounting system that makes it easy to find out which of their expenses are connected with research and which ones, for instance, with teaching. As a rule of thumb, it has been found (by the Universities Funding Council) that the average is 65 per cent teaching and 35 per cent research. There are differences between the various institutions, so you cannot apply a general rule; this is one of the difficulties. We have conflicting reports on this. For instance, the German Deutsche Rektoren Konferenz and the Dutch found for them it was more advantageous, because they had an appropriate analytical system, to have 50 per cent of total costs, which they have to account for, rather than what we call 100 per cent of the marginal costs. The Germans prefer the first system. It appear to give some 5-10 per cent more to their universities. Recently there was a report by Sir John Kingman (and I have this data here) which indicates that for the UK universities it is slightly better to have 100 per cent of the additional costs. Which one is best, I do not know. It is probably different for the various institutions.

Chairman

857. It depends on the extent to which there is a large equipment element, does it not?

A. Absolutely. Then we come to the problem of equipment and overheads. Am I going into too many details?

858. No. We are particularly interested in the overheads, because at the present time, as you possibly know, the universities in this country will lose a slice of money which will be moved to the research council side which will make it less easy for them to match the costs that you expect when you only fund them to 50 per cent. You are aware of that?

A. Yes. Thank you, you have explained it to me very clearly. The other alternative is having 100 per cent of what we call the marginal costs plus overheads. On the average we have a ceiling for overheads on the marginal costs of 20 per cent. This may be acceptable for the average of Europe. It may not be suitable for the UK or some of its universities. If the situation changes in the UK the figure we take as a reference might change. In many cases we have noted, especially in this country, that there has been a slight misunderstanding, because some universities thought that we could accept 20 per cent overheads only on staff costs, which is not true. We accept 20 per cent also on other additional costs; costs which a university department may have incurred just to do the research for which they receive a contract. As your Lordship said, in the case of equipment it varies very much from research to research. In some cases universities want to be able to pay people, and in other cases they want to be able to pay for equipment and in other cases they want computer time. It varies and we must be careful not to create too many straightjackets. The debate is a little complicated. There have been two specific complaints by the University of Belfast and the University of Bristol. As far as we are concerned, we have followed this issue thoroughly and as, I see it, I think the ball is now in the universities' court. It must have been in September 1989, so it is now more than one year ago. Your CVCP and CDP (I always get my acronyms wrong) wrote a letter to all the universities suggesting that specific proposals be made for re-examining the problem, and we are ready to do so, but we have not received these proposals.

859. I think, if I could just interrupt, the problem we have here, and we are well aware of Bristol and Queens University of Belfast because I think I am right in saying we have received depositions from them, copies of which you have had, but I think our problem is to understand the philosophical basis for having 50 per cent anyhow as a starting point. How was that arrived at?

A. Your Lordship speaks of 50 per cent of the total cost, the first solution.

860. That is right.

A. It was both empirical and adjusted by events, 50 per cent is half and half, with adaptations, as I described, for special cases, either very fundamental

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[Continued]

[Chairman *Contd*]

or necessary to the Commission itself, or closer to exploitation especially with industries. Industries accept it and we have not had any complaints.

If we had tried to increase the percentage we pay, then the rate of exploitation of the results by the companies would probably have fallen.

Lord Porter of Luddenham

861. Professor Fasella, as to the difficulties you are talking about in the universities, we seem to be talking very much about the United Kingdom. Is there something about the university system in the United Kingdom which is different or do the other European countries have the same problem with overheads?

A. We have some problems in all countries, but we have more with the United Kingdom of a financial nature.

862. Why do you think that is?

A. I cannot speak as a Community official because as a Community civil servant it is none of my business, but if you accept it I can give you my personal view—and I have worked extensively with British colleagues in my time. Of course, I continue to follow the situation and my impression is that the United Kingdom university system is in a unique position because the amount of financial resources which are being made available are, relative to some other countries, small when compared with the scientific capacity of UK universities and that is where the difficulty comes. You see, I will give you an example. Several years ago, we were considering in one of these consultative bodies where people sit as individuals—very distinguished people such as Sir Peter Swinnerton Dyer, Sir David Phillips, Sir Geoffrey Allen, very good people—with their colleagues from other countries, and we were trying to find out what would be a proper salary to promote mobility of senior people if a professor were to take a sabbatical and we offered him a salary so that he could go and spend it where he wanted in Europe. When we were discussing what would be a fair salary I was very surprised that some German colleagues and some British colleagues came out with almost exactly the same figure for a yearly salary—but each was being more European than the other and the Germans thought the figure was in pounds and the British thought it was in deutschmarks. This explains the plight.

Chairman

863. That is factor three really. I wonder if we could go back just a little bit on the evaluation question, in particular how do you choose your evaluators? The quality of the evaluation is, of course, a direct function of the quality of those people. Do you choose them on an international basis? Do you have, as it were, a body of knowledge which enables you to pick them? When they do their work, do they set their evaluation against preset criteria for a particular contract?

A. Yes. But starting with the last question, because we selected references on the basis of the terms of reference of the evaluation. When a programme is adopted, following strong pressure mostly from the United Kingdom Government—and I think it was a very good idea—the programme has one paragraph that spells out the objectives which become the terms of reference for the evaluation. We could take some of the programmes so that you could see how the objectives that have are defined. So the first concern of the evaluation panel is to verify, to go through the shopping list of objectives established by the Council and Parliament when the programme was adopted and see how many of those objectives were actually reached. This is specific for each programme. Then they all have to express themselves on management—what is correct, what is efficient and so on. Then they have to express themselves on the relevance of the results. So that we ask them —

864. Relevance to what?

A. Relevance of results to society, industry, depending upon what the programme is. If it is an industrial programme and it turns out that, even though industry put in 50 percent, the industrial members of the evaluation panel say “We do not see how these results can ever be used, it was a wrong choice”, or “It was badly carried out”, this becomes part of the report. Having said this about procedures, I’ll turn to the persons chosen for the evaluations. The evaluation is always done by a panel which should comprise people with different qualities and competencies. We always need some persons who are experts in the field from the scientific or technical point of view. We need and generally have one person who is an expert in management, and we generally have two or three persons who are representatives of the users of the research results. If we carried out research on environment which gave information on which a regulation by the Environmental Department of the Community could be prepared, we would ask them to nominate somebody—who may not be interested just in the chemistry involved but would see whether the results are useful for the preparation of regulations. So these become the criteria on which we choose the persons. At first it was rather difficult and now, having played the game for about ten years, we have a database of about 3,000 experts from which we can draw. On a specific programme we normally first ask for nominations, not appointments, by the national statutory committees of Member State representatives. It cannot be a member of the committee but we get suggestions from them. So this is the contribution which each Member State may bring. Then when a user is clearly identified we ask users to nominate experts. If one of the objectives of the programme is, say, to provide scientific base data on which a new regulation on exhaust from industry must be based, we would ask people from ministries of environment but not as officials, as experts, or we would ask the advice of the directorate general which is responsible for the

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[Chairman *Contd*]

norms to nominate persons. Then we have our own list of experts, including the specific scientific consultants I was mentioning before. They act as individual independent scientists, though they must be respected by government bodies. In this we have had great help, because we started from scratch, from bodies like the Royal Society, Max Planck Institute and the European Science Foundation, which give us lists of referees which we then double-check. We sometimes make mistakes but, well —

865. I can understand this working very well, particularly as to evaluation against preset criteria where the research is more directed towards the applied side or strategic side, because you have objectives stated beforehand, but this does present difficulties, does it not, in the more basic work in that by its nature you do not know the outcome when you start because otherwise you would not undertake it? So how do you evaluate that?

A. Right. This is especially true of the programme which used to be called Stimulation and then became SCIENCE. There are two sets of criteria established by the Council decision against which each programme is assessed.

Indeed, such an assessment has been made last year and it is available to your Lordships if you want it. The two sets of criteria are quite different. I would almost say you risk falling into a problem of indeterminacy, because there are things you can measure but perhaps they are not too significant, and there are things which are more significant but measured quantitatively. Those you can measure quantitatively are: how many twinings and joint operations have developed; how many exchanges have occurred; how many papers have been published; what is the citation index on the papers that have been published? These you can do over a five-year span. All these quantitative criteria are useful, but not that much. Let me give you an example: I saw a report in which the criteria of number of patents and publications had been applied to the advanced ceramics industry of Japan, and it came out that Japan was much less efficient than Italy, and then I had some doubts! I think we should use such indicators, but it risks becoming a typical case of looking for your key under the lamp because that is the only place where you can see things. We generally ask also for qualitative assessments. This is generally the task of scientists who report on what significant results have come out of the programme. There I think the SCIENCE programme is probably the most interesting, because, as your Lordship said, there is no specific scientific goal; its objective is just to select good people who seemed to have good ideas in the field of hard sciences and allow them to work together after project selection by good referees. It could be anything: it could be higher mathematics; it could be materials. There is no straightjacket. That is why many interesting ideas and results come out. For instance, there was a group that developed very thin wafers of about one or two molecules thick of

polymers which are spread out on the surface and have two dimensional systems of conjugated double bonds. If the wafers are poisoned by introducing transition metals, especially the higher atomic number metals, they have materials that have most unusual electro-magnetic properties. This was surprising. Similarly there was a group of people that came together and, first, they only asked for a very small grant, and they went to Brussels and they had terrible rows; there were mathematicians interested in the processing of information, there were informatics people, there were solid state physicists and there were neuro-biologists. Eventually they put together a programme which they called "Brain" which produced extremely interesting results. They concentrated on an important feature of information processing by the brain and considered sessions as devices that are adaptive and connective and with a memory, though limited. If they had a full memory and never forgot the system would lose plasticity. This came out from the observation of some simplified brain systems. Then the mathematicians worked on the data which the neurologists had and worked out algorithms to describe the system. Then solid state physicists tried to develop devices that were both adaptive, because when they were adaptive they could connect, and that had a memory, namely the connection remained for some time but not forever. This was extremely exciting and nobody had foreseen it.

866. You have made your point, I think, which is that you have enough flexibility in your way of assessment that if something unexpected comes up and if it is good that is a reason for continuing and not discontinuing, despite what you may have said when the thing began?

A. Yes, exactly.

867. I wonder if you could go on a little bit further on the financial side, particularly as it affects the United Kingdom. You did say beforehand, I think, and you also said in your evidence which I have in front of me that the United Kingdom does have a little problem in this so-called attribution and additionality concept. You are aware of that, are you? Perhaps I should explain it, just to be clear on it. The notion that the Treasury has here is that there is an envelope of money to be spent from UK sources, some of which goes to the Community and the remainder, shall we say, to science in this country through various agencies, but if that which is used by the Community comes back to the scientific community here then the Treasury has, shall we say, a natural inclination to tend to deduct that money from the science block that exists already. That is the problem. Can you tell us whether in your experience, and I think it is very important, that either has been or is likely to be a deterrent to British scientists in coming forward for money? It seems to be such an obvious disincentive.

A. In spite of the fact that I do believe it is a disincentive, we do have very many proposals from Britain; the quality is increasing, especially in the

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[Continued]

[Chairman Contd]

most interesting programmes. Because project proposals are selected on scientific merit rather than on automatic "just return", this leads, for some programmes, to a high level of acceptance of projects which happen to involve UK scientists. If you take SCIENCE programme that was mentioned, in some years the British receive around 28 per cent of the funding. In other programmes they have less. Figures for average participation of different countries depend upon what period and which programme you consider, and if you include or not the Joint Research Centre, or if you include or not JET. There is at least one person in this room who knows quite a bit more about JET than I do. The returns for the UK on JET are not negligible. I speak in purely financial terms. Since scientific and technological merit is a key criterion in project selection in each of the programmes, there may be countries that participate more than others because they submit more projects of higher quality. This may be hard to accept by those countries which participate less, and may lead to pressure for an automatic "just return" system. The interests of each and every Member State must rather be sought in the choice of the programmes, in the equilibrium between the programmes and through structural help for less favoured regions. Moreover, all EC supported projects involved more than one country, and they often lead to co-operation between regions of different S&T level. Returning to the UK situation, I think that if attribution is applied as your Lordship described, it would be a disincentive. In spite of this, the British participate intensively with good projects and in the SCIENCE programme and some others get more than "just return". It means their projects must on average be better than those of other countries. This is on the basis of a scientific and technical refereeing report which is made by experts of all countries. It means that the Germans, French and Dutch agree that those proposals are better than others. The net result is altogether positive. It is not true in all programmes and, as I said, on average you are slightly above your "just return". In some you are way above which means that in others you are quite appreciably below and this latter situation might spread, if indeed the attribution disincentive works. I myself, as I understand the system, have the impression that it penalises the UK researcher twice—first at the time when the Framework Programme is approved, then when the projects are selected. The Framework Programme which sets down the figures is approved unanimously, so each country may block its adoption. The national treasuries get involved and before the UK minister may accept the programme he must have (as you explained) the agreement of the Treasury. I have been told that the Treasury then says, "Okay, the Community research programme on environment requires a certain amount of money. 18 per cent of that corresponds to the UK contribution, funds for the national research programme on environment will be cut by that amount." I suspect that this occurs not only in Britain but also in Spain and other countries. I am

certain. It is only from the UK that the problem has been brought to my attention. Then, as I understand the system, there is the risk that British colleagues may be taxed a second time when the projects have been accepted—they say it may occur and this would become a deterrent. Take the environment again. The national support for environmental research has been cut by 18.1 per cent which is the British participation in the Community programme, so they have a little less. They compete. Suppose they sent in at European level very good proposals and they got 20 per cent. Then they fear that the British authorities would say "ah, you have 20 per cent for the Community budget so you get less from us". At this point the United Kingdom researcher would lose twice. I do not know if this actually occurs, but if it does—this is an internal United Kingdom affair—it seems to me it is bad for Britain.

868. And can frustrate what you want to do if you have a policy.

A. Yes. If a programme has been accepted, it means the United Kingdom Government has agreed to it, since the Framework Programme requires unanimity. If in fair competition United Kingdom researchers get more than what would be the bureaucratic share, why should they be penalised? They should be encouraged. So if this indeed happens, again I am surprised because it does not seem reasonable. Perhaps I should not have said that and I hope I misunderstood the system.

869. You have been perfectly well understood. We are most grateful to you for that explicit statement. Could I just ask one other question about this funding, particularly as it involves now so many countries within the Community and you have a positive philosophical duty to perform as well. You have the criterion or social cohesiveness, for example, if I understand it correctly. There must be great differences between the ability of countries to perform. Do you find yourself in the position of having to say, "Well, we would support it in country X, it is not strong, but for the purposes of bringing it up we will put support there"? Has that caused a deleterious effect on, for example, good work which could be done by a strong country because it is good?

A. There are problems, but so far we have been able to cope with it. Problems exist not only among countries but also within countries. For instance, my compatriots have a less than average participation in some programmes and this participation is often a very small part of the country. In some technological programmes, it is predominantly from Lombardia and part of Piemonte. There they are quite competitive, in the south they are less so, or less interested. We are committed to the criterion of excellence; so far we have succeeded. But in other activities of the Community the problem of cohesion in relation to research is taken care of. So our principle is that when you go through approving a research project you must base yourself on excellence. If you do not it is, first of all, bad for the less privileged regions from which you accept lower

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[Continued

[Chairman *Contd*]

standards. It is better to have fewer excellent projects from, say, Calabria or Crete than to have many mediocre ones. We must remember that participants pay 50 per cent, so if we encourage them to put limited money and limited human resources into second-rate projects, we are doing a disservice to them. We have often maintained that they can use the Community refereeing system, which I think is quite honest and good, as a free alternative to going, say, to Batelle Laboratories. If they have a project and they want to know if it is worth putting the money in and they send it to us, we can tell them "The project is not so good, don't put any money in because it is obsolete", or "Somebody else has done it" or "It won't work" or "It's not commensurate with your strength". If you go to Batelle Laboratories or Arthur Andersen or any other consultants, you have to pay. So we give that advice for free. It is not always accepted that easily, but it is something we try and say. But in order to be excellent, you need people, you need trained people and a minimum of infrastructure. So for the regions which are underprivileged we do have programmes which are not part of research. They are run mostly by DG XVI, regional programmes for infrastructure, and we interact with them very closely. Now, there is a fund called STRIDE for research, which includes several million ecu for Northern Ireland. We singled out STRIDE in the broader framework of regional policy funds also because it is sometimes very difficult to persuade national or regional authorities to reserve some money for research. It is long term, it is not so flashy, and sometimes it is more attractive to use the money to create one more autobahn than to create a laboratory the value of which corresponds to a few kilometres of autobahn. So it is good to put some money away for research infrastructure in less privileged regions. This is one thing. Then, of course, we promote training. There are special programmes like ERASMUS for students and COMETT in relation with industry. If less privileged regions can train their people and are given infrastructures, why should they not be excellent? In any case, the data on the relative participation of Member States in EC programmes are available, both within the Commission and in the Member States.

Chairman] I am afraid I have monopolised the conversation from this side. Could I turn to my colleagues and ask if they have any quick questions they want to raise?

Lord Sherfield

870. Professor Fasella, when you came to talk to Sub-Committee B about a year ago—or just over—we had some discussion about the problems of definition of "pre-competitive" and "research". We talked about "strategic" and "near-market", you talked about "pre-competitive" and "post-competitive". Then you said the phraseology you preferred was "pre-normative", I remember. I wondered

whether you had in this year that has gone by had any experience of difficulty arising from these rather different forms of expression.

A. I think we have had difficulty with the substance of the programmes and the difficulty with the words just reflects the real difficulty. Your Lordship mentioned "pre-competitive" and "pre-normative". Pre-normative goes well, keeping our fingers crossed. Everybody agrees that in a scientific and technical world that evolves very rapidly it is important that when norms or standards are needed they be based on the best that science and technology can offer. I think in the past there have been political problems which have been in all the papers, like the difficulties we have had with the Americans on the import of animals treated with bovine somatotropin. The solution of these problems could be helped by a broader, common scientific approach. So, I think everybody agrees with pre-normative research and, indeed, we are encouraged to do more. I think that one important area which we need to pay attention to in this field is to make the best use of molecular biology, cell biology, *in vitro* testing, NMR and so on. That is very well developed in this country. One should progressively upgrade the scientific basis on which registration of new drugs is based. As of now we do not always use the most relevant evidence. Developing new drugs is very expensive—it costs the best part of \$150-200 million to take a new molecule from your mind to the market and the best part of 10 to 12 years.

Much of it is for providing the evidence that these molecules are safe, of good quality and are effective. Many of the protocols on which this registration is based are now obsolete. We should make the most of *invitro* testing, *invivo* diagnostics and better animal models so as to make preregistration work more significant and less costly, starting with drugs aimed at the expensive diseases. We have made a study in which we classify health expenditure on a nosographic basis. Such spending in the EC is now more than 150 billion ecu per year, which is a lot of money, and some of it is badly spent. I think this is a typical area where a great effort of pre-normative research should be made. This is the positive aspect. Pre-normative research is accepted. With pre-competitive we have problems. First of all, within the Commission itself because we have DGIV, which is responsible for the competition rules, that looks with great worry at any support for research which approaches the market. On the other hand, we have other services in the Commission which say—and you all read I think the article by Mr Bangemann in the *Frankfurter Allgemeine Zeitung*, where he has set out his five principles of industrial policy. So research becomes part of that discussion, which is complicated by events going on in the Uruguay Round in GATT. All this requires a re-examination very much in depth. As of today I am here and my colleagues are at a meeting with DG III (industry), DG IV (competition), DG I (negotiations in the GATT frame) and DG XIII trying to develop an approach which takes as a reference the five

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[Lord Sheffield *Contd*]

Bangemann points. I think the difficulties are now greater than they were when I was here last. It is not only a question of words, but there are real issues at stake. How much public funds should go into companies and under what conditions.

Lord Porter of Luddenham

871. I think Professor Fasella has answered most of the questions very clearly as far as I am concerned. I have perhaps just one: you explained to us very well how the evaluation is carried out of a project or a programme once it has started, I was less clear about how the decisions are made at the very beginning on what areas should be supported. Are they mainly based on applications? Are those applications guided by the areas which you seek applications for? Put another way, as we very often do in this country, are they bottom up or top down?

A. I think they are both, and they should include both. This is what we try and do. On the one hand, even within the Commission services, there is a school of thought which is perhaps Cartesian in which you describe a system and say that is what we need and select the area; but on the other hand, there are other persons, and that is one of the advantages in the Community, in which various components of the European culture come and say, "Okay, you have this strategic approach, but let's get down to facts, and let's talk to industry, let's go to researchers and see what they have in their labs and what they have in their minds and what they think they would like to do at Community level". We then combine the two approaches, and sometimes we have done it literally on paper, getting suggestions from persons who have followed one approach and the other and then we make adjustments. One needs some overall planning but one should not ignore the reality of the problems and opportunities seen by people in the field. It is not always easy, and I am not certain we always strike the right balance. That is why there is the ex-post evaluation that comes in to correct things when we make mistakes.

872. You say there is always a slot somewhere for a person or a group who have some completely new proposal which does not fit into an obvious subject group and so forth; if they applied for support there is always a slot?

A. Yes, within the limits of available funds this is what the SCIENCE programme was about and now it is carried on in the so-called Human Capital programme, but it is the same approach. As my Lord Chairman said, the really new ideas we cannot predict. How could we write down the objectives of a new scientific approach if the idea is really new? We must leave that open, but there is some pressure against it, especially in some national administrations; the idea that you have a programme in which you do not spell out how many Nobel Prizes (and in which areas) you are going to win.

Chairman

873. Your function really is to be reactive and proactive?

A. Yes.

Lord Adrian

874. I have no questions, but I would like to express the hope that we might be able to have examples of the terms of reference of particular projects under the various heads, from the SCIENCE programme right through to the industrial programme because it would be extremely helpful for us to see that.

A. Yes, we can send them for all programmes and you can look at those which interest you.

875. I was hoping that you might do the same?

A. Yes, I can do that.

Chairman

876. Perhaps you can describe the continuum of the spectrum?

A. The Community always circulates too much paper.

Lord Kirkwood

877. Perhaps a rather more mundane question for Professor Fasella but one, nevertheless, which I think concerns a lot of scientists who are making submissions to some of the framework programmes. There is a large bureaucratic procedure that has to be gone through, and that is certainly one thing that puts off a lot of people making applications. There is a lot of expensive travelling and there is a lot of time which is involved and even a successful programme gets no reimbursement for all that cost. Would it not be an encouragement to reimburse the costs that are incurred whether the submissions are accepted or not?

A. Your Lordship, you raise at least three crucial points. One is the problem of reimbursement. I think it is indeed a very interesting proposal. I think it must also have been at least indirectly suggested in either the Belfast or the Bristol report. We are experimenting with it in the BRITEURAM programme which, being also addressed to small and medium enterprises, is particularly sensitive to these problems. What we have tried to do—and there is an interesting evaluation done by IRDAC (which is the committee made up of knowledgeable individuals that advises us on industrial research) is what we call the feasibility awards. Organisations which have a good idea where they think it would be expensive to make a full proposal, can apply under the feasibility awards. We cannot give them to just anybody because you have the most crazy ideas with some of the proposals we get. There would be a screening and those which are selected receive full reimbursement for the feasibility study. This is one system we have been trying out and which is now being evaluated. If your Lordships are interested I can

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[Lord Kirkwood *Contd*]

have the paper on that sent to you. Then there might be the idea, and this is a new idea, preparing accepted proposals.

This is, I think, certainly worth exploring; maybe not the whole costs—I do not know—but it is certainly worth exploring.

Chairman

878. Well, Professor Fasella, we do thank you very warmly for having come and given us such a very interesting insight into so many problems of

concern to us. We must say how very grateful we are to you. I hope it has been worthwhile from your point of view.

A. My Lord Chairman and my Lords, I feel very privileged at being among you and I always come back with more ideas which is perhaps an even greater privilege.

879. I think I should say “safe journey home” today, should I not?

A. Thank you.

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Examination of witness

PROFESSOR J A McCLEVERTY, University of Bristol, called in and examined.

Chairman

880. Professor McCleverty, I think you can see you are among friends around the table.

A. Certainly three of them I know directly.

881. You have a list of the questions and you have the advantage of listening to the exchanges we have had with Professor Fasella. Is there anything you would like to say by way of general introduction or would you like to speak directly to the questions you have had, or are there any other observations you care to make?

A. Well, Lord Dainton, first of all I would say how much I appreciate the chance to come here and to subject myself to questions and to think about the issues you have raised. I do not intend to make a lengthy statement. I would prefer, in fact, to respond to questions. But before I do that I perhaps ought to give a little bit by way of explanation of what I, in a sense, think I am doing here. You should be aware, my Lord, that I am of course a professional chemist and regard myself as being primarily that, and for that reason I will speak to you about what I see as happening in chemistry, and how it relates to various questions you may raise. However, I also, for my sins, am Chairman of the Chemistry Committee of SERC and that gives me a certain privileged view of what is happening in chemistry in the United Kingdom and how we fund it, or more correctly how we are unable to fund it, at this moment. I am also, by virtue of that position, a member of the Science Board of SERC and so have access to what is going on in other sciences. For those of you who are perhaps not so familiar with that particular organisation, the Science Board is responsible for the funding of what we properly call pure science in the United Kingdom, at university level certainly. By that I mean mathematics, physics (which does not include particle physics and astronomy), chemistry, of course, and the biological sciences.

882. And earth sciences?

A. No, the earth sciences only in part. Some are dealt with by NERC, we do not often see them. Therefore, I have a certain view of that. It is with that little bit of background, coupled to the fact that I have served three universities, one of them as head of department, that I can say that I have a little experience of what is now called management; so I hope I can answer some of the questions you may put at least with a little experience, hopefully with a little wisdom.

883. Could one ask right at the very outset, having heard the discussion which has gone before and knowing the general problems which face British science in SERC, how you see the ordinary, as it were, coalface scientist or bench scientist facing up to the problems of the future, given the kind of inevitable bureaucracy involved in going to Europe

and, in addition to doing this, also having the relative shortage—if I understood you correctly—of funds available to SERC?

A. That is a very wide-ranging composite of questions. I think against the background of the answer I will give, that you should be aware of the very acute financial situation that science is in right now as a result of difficulties at SERC in terms of the lack of money. So any collaboration that we engage in with Europe, with North America, with anywhere in the world has to be viewed against the ability of British scientists to mount a collaborative programme with their own resources. Much of what we do at a personal level in collaborative science is done on the basis of a so-called well-found laboratory. In other words, if I want to collaborate with somebody in Sweden, I will find somebody, not necessarily coming from a sponsored programme involving the EEC or indeed any body, perhaps by a chance contact whom I convince or through reading the literature knowing somebody. If I want to establish that contact, I will approach that person, we will agree what to do, then look for a funding organisation, but we do that against a background of belief that in our own laboratories we can actually do the basic fundamental science. What we are looking for, therefore, in forming a joint programme is the added value we would get in terms of intellectual stimulus and belief that with two people working together on a problem the mutual increase will produce results which are greater than that combination—in other words, two plus two can equal five, if you like, in terms of the benefit we should get from that. We are greatly embarrassed in this country because of the difficulties we have in chronic under-funding of science. We just cannot always do what we are asked. I give specific examples without naming names or institutions. I know of an individual who has a programme in environmental science which is funded through the EC and he has collaborators in Norway and Germany. The basis of this collaboration is that this person will get money through the Atmospheric Chemistry Initiative recently established by the Chemistry Committee in the Science Board of SERC. The project which this person has put to the Chemistry Committee through the Science Board has been approved but it cannot be funded because there is no money, so this man is in a gravely embarrassing situation of not knowing how he can move forward with his European colleagues to develop this further. He does not have essentially the key which opens his particular door and in that sense I think we are considerably disadvantaged. Now, I would say that the current financial situation is perhaps of a limited nature. We do not know, but it is one which you might call a recurring phenomenon and I know at least one of you has suffered in that capacity in SERC and knows exactly what I am talking about. Our worry about the funding scenario in terms of pure science through the Science Board is the capricious nature of that funding—it can be turned on and off. It is currently turned off because

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[Chairman *Contd*]

we face a very difficult situation with respect to currency fluctuations, with respect to inflation, with respect to salary increases over which we have really no control.

The situation has been brought, I think, to a very acute point this year because, in addition to the fact that we have all these accumulating factors over several years, of failure to recognise that innovation in chemistry or physics or biology is different from innovation in terms of the price of a loaf of bread. That failure to recognise that is cumulative. This year, of course, we had a much lower public expenditure settlement. In round numbers normally the Science Board gets about £44 million to spend—I beg your pardon, that is not correct. We would expect this year to have about £44 million for research grants. In fact, the real number we are working with right at the moment is £24 million. When you strip that down and look at the chemistry component, last year the chemistry component was £10 million, this year the best it can hope for in a situation pre today's war was £5 million.¹ If you take an Aberdonian Scotsman's view, like mine, with a rather genetic interest in money matters, I would say we might get away with about £2.5 million. That is to provide support for chemistry against a £10 million scenario for research grants last year for the whole of this year. I make it even blacker. We do not even have that money now so there is no budget for this year and it is against that scenario that we are trying to engage in international collaboration.

Lord Porter of Luddenham

884. Could we ask for clarification there? This is not yet international, we are talking about what one sees as relevant. What I wanted to ask you is this: the actual overall science funding is about 4 percent up in cash terms, that is to say about 6 percent down in real terms, is it not?

A. Yes. What you are saying—and I am sure you are right, but nevertheless the figures are often more depressing than one expected—is that the science board is far worse even than science as a whole, and chemistry is worse than the science board? 44-24m and 10-5 is much more than a 6 per cent. drop, which is the science drop?

A. Yes. I am not going to make a special case for chemistry. The figures are sufficiently dramatic to illustrate the point.

Lord Porter of Luddenham] The science board is almost half.

Chairman

885. When you reply perhaps you can tell us whether any bearing on this is the fact of fixed subscriptions to international activities?

A. I am glad you raise that, my Lord, because that is, of course, one of the issues which worries us considerably. To explain: one of the major international subscriptions we have is to CERN, which does world class science. In all my comments please do not assume I am denigrating the science this time, that is not what I am saying. What is of worry is the fact that we have a fixed subscription to that and over the last ten years, to CERN in particular, we pay as a nation a subscription which has been roughly level in Swiss francs, that is for the last ten years. However, because we do not actually have Swiss francs we pay in pounds. I am sure you are well aware of inflation over the last ten years, and this year the current subscription to CERN is approximately £50m, give or take a million or two. We are approximately £10-12m overspent this year, purely and simply because of currency fluctuations. This is something over which we have absolutely no control. That is a fact. Taken within the way in which we fund science in this country, the money we get in the science vote is essentially cash limited and that feeds all the way down to SERC. The SERC pays the subscription to CERN and it pays whatever is required in pounds. As I have told you, we are £10-12m overspent, but the practical effects of this international collaboration—which is valuable, I am not denying that—are that every time there is a lurch in the currency fluctuation, which is usually detrimental. It is the “small” sciences, the ones which use small amounts of money, short-term contracts, personnel-based only, which are the ones which essentially have to take up the slack. They are the things you can stop instantly. You cannot close down a national facility like Daresbury just like that. Regrettable, and something which I feel grievously upset about, is the fact that you turn off chemistry, biology, mathematics and small physics. This is a problem which I have to say is not new. I think I am correct in saying that three maybe four years ago to a committee of your Lordships, my predecessor's predecessor, as Chairman of the Chemistry Committee, made a comment very similar on these lines: it goes on and on and on and, please, can we do something about it.

886. I have to say our problem is international science programmes in this Committee. Are you telling us, which I hope I have understood correctly, that the small sciences—in terms of each unit being a small spender and not committed for years ahead, which distinguishes it from large international programmes—do in fact impose a double penalty: one is you are getting less of the fraction for your own domestic expenditure and, by the same token,

¹*Note by the witness:* The Science Board normally received from SERC Council about £130 million in total. Of this, 40 per cent is committed to research grants—for the fundamental, curiosity-led, explorative studies underpinning the UK's competitive edge in science. 25 per cent is committed to studentships, 32 per cent to instrumental facilities, including international subscriptions, and less than 1.5 per cent to office administration. Commitment to research grants in 1989-90 was £44 million and in 1990-91 it is probably less than £24 million. Chemistry normally receives about 1/4 of the Science Board commitment, so this year we expect to have to work with £2.5 million or less as against £10 million last year.

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[Continued]

[Chairman Contd]

you are a less well-founded laboratory and less well able to enter into collaborations internationally. Is that correct?

A. Precisely.

Lord Nelson of Stafford

887. I wonder whether we can have a response from the university to Lord Adrian's point which he made earlier on, the degree to which the non-reimbursement of costs of submissions to the European Commission is a deterrent to universities putting forward proposals?

A. It is a problem. Any time you want something you have to spend a little to get it. I think I would be less than honest if I said I have not yet been deterred by taking the long trek to Brussels. I can usually recoup that if I am successful. The problem comes when your income, as a result, is far in debit in relation to your outgoings. I do not see an easy solution to that. In a sense we are trained to go looking for things, and that has been developed over the last ten years. We are now very much more conscious of the need to go scouring around the market looking for people to sponsor what we want to do. I believe, in terms of national science, government has a responsibility, but I am not here to air that particular point. I do not feel especially deterred, given the way things are, in making applications to the Commission in Brussels for funds because of the need to actually go there. Some universities indeed maintain agents in Brussels who will essentially act as go-betweens, find out what is available and make sure the university or consultant knows about these things. In many universities there are offices whose sole duty is to scour the European journals who learn to translate Euro-speak into something I can understand. That is valuable, but of course it is a net cost. The universities have become more than just occasionally conscious of these matters. If you employ somebody to do that you must be sure of at least covering the salary and office costs. I cannot really comment on that because I am not a real specialist but I know there are problems.

888. You would see the corollary that to participate actively in an international programme is an advantage to the university in attracting good people, and so on?

A. Yes, there are two levels there: one is the need in some sciences to use large facilities, which no nation really can afford. I am thinking, for example, of the neutron facilities as established in Grenoble or ISIS which is a similar but different type of thing. That kind of international collaboration of course is vital because it provides a corporate facility which participating countries can send their scientists to use. The other side of that coin is the fixed facility. When you run into hard times you are faced with the problem, well, we cannot close it down right now, and if we could close it down who pays the redundancy money, etc? For many scientists involved in certain types of materials that is a vital

facility. The other, and equally important international collaboration, is the thing we engage in on a personal level. For example, in my own laboratory I have very close collaborations with Poland, Italy, Germany and Spain, and this brings foreigners into my laboratory which is a very educative thing for everybody.

889. Your people get access to their labs?

A. Yes, they do indeed. I have to say that the traffic in some cases tends to be outwards with post-doctorals, people who have their degrees in this country; they would rather go out because they think there will be better facilities to do certain things. That is against the background that they may not be specifically good at languages but they go nonetheless. To have this international collaboration is vitally important: it is stimulating, you create very good relationships across national boundaries. I have had people from Iraq in my laboratory and I am wondering about their situation now. I value that and I encourage it, but there is a side that you may not be so aware of: the British Council facilitates these and does a wonderful job, particularly recently. They have had a little more money and that money has been spent exceptionally well. For example, there is a wonderful programme between Spain and Britain, called Acciones Integradas, which facilitates the exchange of Spaniards and British scientists exchanging. There is a similar programme in France called Alliance, and there is another one in Germany. These programmes allow foreign nationals to come here, and for us to go there. What they do not provide, and it is quite a problem, are the resources whereby you can actually do the research. If you need, for example, 25 gallons of acetone you have to find it out in your own resources of your own laboratory; the British Council cannot supply that.

In Spain it seems less of a problem. In this country it is becoming difficult. It is not particular to the British Council with Europe, it happens with all international co-operations, including the Commonwealth Commission which sends students here. We are very happy to have them, they do provide bench fees, but those are modest because they do not have the resources, and because of the particular financial situation British universities are in we have to look for some kind of support in order to allow these people to do the research they believe they have come to do.

Lord Adrian

890. Could I ask about the evaluation of research? In particular how far are the Research Councils consulted or asked for advice and judgements when there is a proposal to take part in an international scientific programme? In particular do the Research Councils give what you might call financial thought to the consequences of their recommendations with respect both to good times and hard times?

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[Continued]

[Lord Adrian Contd]

A. Well, again there are a lot of answers to that. It is difficult for me to give a fully comprehensive answer because I do not actually know how some of these things operate. I can only tell you what I experienced during the time I have been with the Chemistry Committee. There appear to be very little consultation, for example, with the European Community. There are interactions but these are stimulated in a different way. So I cannot tell you how a programme is mounted. I am not suggesting there is anything wrong, I just do not know. Nobody has told me—I have asked questions and I do not get answers. There is, I think, a very effective relationship between the international section of the SERC and the Cabinet Office. The Cabinet Office interacts with Brussels, as I understand it. I have not had any significant interaction during my time as Chairman, admittedly brief. I think it is a pity but it is something we can resolve. In terms of formulating programmes things obviously happen when there is a perceived need for them to happen. So if you need to establish some kind of new facility which clearly has to be international because of the cost of it, then I would believe that scientists will express that need and will find the way of approaching whoever can enable it through the various organisations.

891. Is there in your experience evidence that the Research Councils' secretariat, or whatever it is, gives advice to the members of the Research Councils to say that "You realise that if this is taken on this may be a major financial burden on the Council in five years time"?

A. Yes, I think it is fair to say they do. They are well aware of this but, of course, we work very, very closely together. I think the difference between the SERC secretariat and people like me is that they have one job, I have several, but we meet quite often and exchange views about these things. One point I would like to make, however, is this: I was most interested in Professor Fasella's comments about evaluation. I know, again speaking with the knowledge that my fellow chairmen have the same view, that we are not consulted very much about evaluation of scientists; it is done at a European level. I am not quite clear exactly where we stand in relation to the mechanisms for exchange of information but, to my knowledge, at least as far as chemistry is concerned, we had our first contact ever with a body within the EC in relation to evaluating chemistry which arose from a request from a former director of ICI who represents us on CODEST for some advice as to how chemistry could be evaluated because they were running into problems. The size of the subject is so vast today that to know which part of chemistry is to be considered: is a major problem. This gentleman invited the Royal Society of Chemistry to suggest a few names—mine came out of the hat, I am known there, they know my connection with SERC, and we have made a proposal. This is the first time we have actually had contact there. Out of that came most interestingly a list of referees which CODEST uses. It was a list of all the Europeans—I am not intending to embarrass

Professor Fasella, nevertheless I must say this—and it was very revealing as to who was there and who was not.

Chairman

892. May I interrupt? Did the list that came out give you any confidence or otherwise?

A. Well, I must be diplomatic, Chairman.

893. I do not see why.

A. There were people there whose names I did not recognise, but some of them I would not recognise because they were in fields of chemistry with which I have no acquaintance, but there were names there and names of some of your Lordships' colleagues which were not there. I was surprised at that because they are active scientists. The comment we wished to make to the person we were meeting with was that the Chairman of the Chemistry Committee and his sub-committee chairmen are probably, at least as far as the United Kingdom is concerned—I think it is also true of the CNRS and CNR and the German funding bodies—people in touch with what is going on in science in their countries and very well informed, they have excellent back-up facilities. It is a great pity that these are not used more extensively. While I am certainly not looking for more work, I would certainly, with the benefit of my audience behind me, wish to emphasise that nevertheless we have knowledge which is available.

Lord Porter of Luddenham

894. Professor McCleverty, I think you have raised a very important point of principle here. The list that you talk about was different from the one you would have provided?

A. Yes.

895. Is that not a good thing?

A. In some ways.

896. What I am getting at is, obviously the European Community must seek advice from the scientists in the country and it could go to the Royal Society of Chemists or the Royal Society or ICI or whatever. But is it not wrong that it should go to the only other funding body that the poor man has to go to? What I am saying is that some diversity is absolutely vital because I think even you would agree that you do make mistakes sometimes?

A. Oh, sure. Yes.

897. We all do.

A. Yes.

898. There are not many places that scientists in physics or chemistry can go to. As you know, they can go to SERC and they can go to the EC and that is about it. Do you think in view of what I have just said that SERC should really have a say in who is

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[Continued]

[Lord Porter of Luddenham *Contd*]

there. It provides its own list which is already used and it has probably turned the man's application down. Should it provide its own list to the EC or have an alternative route?

A. There are several points there. Firstly, a lot of things we get we do not turn down, we just cannot fund them. But we have a few and it is good science. What I am saying is there is a corporate body of opinion, a body of expertise rather, here that the Community can use. We are not seeking to impose, we would not want to impose SERC as the only body it could negotiate with, but there is a variety of expertises which the Community does not appear, on the basis of the list, to have knowledge of and to be accessing. We have a complete list of names we use for our referees, we would be happy to make that available to the Community to use. These are people whom we use ourselves, we know they are in good standing, professional scientists who do good service. The Community is entirely at liberty to take any other names it wishes. We were a little surprised not to have been approached at least at my level.

989. Would you not agree that, in these very difficult times when one very small grey mark is enough to provide an excuse for no funding, it is a good thing that one referee cannot follow a person's applications around the world?

A. The point is well taken. I think that is why you do need something else. We discussed at this meeting with the CODEST representative whether it would be helpful to have a panel of people to look at the applications and the referees' comments in order to establish that just the point you raised is not occurring, so that fairness is not only done but seen to be done.

Chairman

900. Professor McCleverty, we have covered a lot of ground. There is one point we have not touched on which is the last of the questions you have on the list we meant to touch on. It is perhaps a suitable one on which to end and one which concerns us in this Committee quite a lot. That is how best to make decisions about what international projects we might join or not join, how that decision is made and, in particular, in view of what you have said about the fact that if there is a fixed tranche of money available, international projects by being established also establish for themselves, as it were, a right of freehold and consequent on that, whether any pressure on the total is magnified on the residual which you call small science?

Have you got any views about how we do these things in this country. Do you think that our arrangements for deciding to participate in this or that international project are satisfactory, or have you not been involved?

A. I have not been involved, my Lord Chairman. I think that the only comment I could make is that clearly these decisions are taken at many different levels, some political, and therefore we have no particular way of influencing that, other than the

fact, I would hope, when we are about to engage in an international project that those people who are best qualified to comment on the science are approached and asked for a view. If science is good then it should be clearly stated as such. Whether the money is available is a different issue clearly, and whether political aspects are right or not is another issue, as long as scientists are approached, and I have no reason to believe that in the past they have not been. The fullest consultation, commensurate with efficiency, is desirable. I have not experienced that at a major level. The only thing I would say is that in relation specifically to chemistry an initiative has come up about international collaboration, particularly through the EEC. This arose from a discussion among a group of chairmen of chemistry committees from the European Community meeting together by mutual agreement, and deciding to form a lobby group in Brussels. As a result of that they have persuaded the Commission to establish a COST ad hoc committee on chemistry to attempt to develop a proper named, established, fundamental chemistry programme within the science framework.

901. Does this arise in part because your chemistry colleagues in other countries feel that they are under the same kinds of pressures that you are here being a small science?

A. It is not specifically small science but a perception that chemistry has not been recognised as the important science that it is and with all the contributions it has to offer. That is not to say it does not appear in the Community's programme, but you have to look very hard. There are so many things that that science can do which are beneficial to European bases that we think there should be dedicated programmes. That committee has met several times and we are attempting to establish this as a way of influencing the Community's policy. With this country's support it is a little difficult to see how this will work, but I believe having developed what we have, and this is done in collaboration with SERC, certain aspects of this will be looked at in the Cabinet Office and advice given to us and to Brussels as to what we can and cannot do. We have not got to that stage yet. There is a little bit of a mystery in how we progress matters from having decided the science is good to actually getting the money to support it. I do not really understand the details of additionality or attribution, I have yet to meet many people who do. If we do actually establish a dedicated programme, and in particular an aspect of pure basic fundamental science, then the attribution factor may very well take the money we think we are going to get out of Europe out of our own research council's pockets so we lose twice over. My information is that this year at least, or next year, notwithstanding the difficulties we are in, the attribution factor will not work against anything within the Science Board, largely, as I understand it, because most of the programmes in the Community are of an applied nature. We would like to see the

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[Continued

[Chairman *Contd*]

Community support more fundamental science.
You cannot develop applied science without a solid
basic fundamental understanding.

I think on that note it is time to conclude and to
thank you, Professor McCleverty, for coming to
meet us today. We are most grateful to you.

A. Thank you for asking me.

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Evidence from Academia Europaea

I will comment on the European part of British co-operation in international scientific programmes. I believe there are considerable advantages in European collaboration in science. These stem from three considerations, the enlargement of the effective scientific community, the sharing of costs particularly for areas of high cost science, and thirdly the provision of a coherent voice in discussing global projects with major partners such as the US, USSR and Japan.

The first consideration, the enlargement of the effective scientific community, can be achieved at small cost and is already being dealt with by the European Science Foundation and more recently by the Academia Europaea. The essential purpose of these organisations is to provide means in their different ways for European scientists to discuss their problems together as a preliminary to making research collaborations which can be funded by national research organisations. I believe these efforts are now quite effective—I would cite just two examples from the European Science Foundation. The Network Programme has so far set up 22 networks, which are international in Europe and, as far as possible, interdisciplinary, within which scientists can meet and develop ideas in their subjects. The second is the formation of the Ocean Drilling Consortium. This latter is an important geological programme conceived in the US and is concerned with the deep oceans. The US offered shares in the programme to other nations; France and Germany joined early. The UK had difficulty in raising the money but joined a little later. This left most other European countries out in the cold. The ESF then organised a consortium of smaller countries which were able to acquire an interest. Overall, the four shares (out of twelve) give Europeans a considerable influence on the development of programmes which could not have been exercised by individual countries. Thus an effective voice in a global programme, was achieved.

It must be remarked that the delay in British participation in similar ventures for solely financial reasons is an unpleasing spectacle that we have unfortunately become used to. It indicates a failure of political will to accept the financial consequences of joining multilateral schemes. The basic problem here is that such costs are not kept distinct from the rest of the disposition of the Science Vote. For instance, the ODP contribution is attributed to the NERC budget and CERN to the SERC budget. Contributions to these large programmes unduly effect the balance of the research council budgets. Additionally international exchange rate fluctuations cause unacceptable distortions of the funds available for the funding of the rest of the domestic research. This problem is exacerbated by the markedly lower proportion of GDP devoted to civil science in the UK compared with our major partners in France and West Germany.

I have already mentioned the role of the ESF in European science. It operates with a small budget and is, in my view, a rather cost effective organisation, with research priorities determined by scientists, and being referred back to national research organisations. However, while its budget is derived from the budgets of member organisations, it amounts to only a tiny fraction of the national science budgets. For this reason it has little opportunity to grow and hence can only be a minor source of funding in international collaborative research. In contrast the Commission of the European Community (through DGXII) disburses considerable sums of money mainly in the field of applied science and engineering though it has recently moved into more pure research and also interacts with research through its educational programmes. Its disbursements are of the same order as the total science vote in the UK and must exert a considerable influence on scientific research in Europe. It is possible that UK scientists benefit relatively well from this source but its range and direction are quite frequently opaque to the average scientist and it is improbable that its priorities are close to those of the UK councils.

A further and related aspect of the UK's involvement in co-operation in science in Europe is the implications for UK diplomatic missions or delegations to supranational bodies, most notably the EC. Do these delegations always play as effective a role as possible in influencing, and thus having the UK benefit from, the direction of both pure and applied research spending? Few delegation officers, it seems, have a scientific training or a wide knowledge of science and technology. The permanent staffs of the scientific directorates of the Commission, for example, are not seen by the delegation as priority areas for the placement of British personnel. The average level of seniority of UK staff in these directorates is, in general, low compared with other comparable UK candidates to be proposed and suitably supported for more (economically or politically) important posts. Arguments against accepting this argument are the simple difficulty of proving it and more importantly the counter claim that technology, in particular, is increasingly important in determining economic stature, performance and prestige. It is clear that heavy lobbying for senior posts goes on and why the UK should adopt an attitude of being above it all for scientific posts is not clear. The consequent dominance of UK influence in the other fields is not a frequently remarked fact.

Evidence from Dr Gordon Adam, MEP

The current 1990-94 framework programme overlaps with the 1987-91 framework programme, and is not yet fully operational, since none of the specific programme decisions have been adopted (proposals for 13 of the 15 specific programmes were introduced in Parliament in June 1990).

The Council decision of 23 April 1990 (90/221/Euratom, EEC in the Official Journal of the European Communities L 117 of 8 May 1990) fixes the financial envelope at 5.7 billion ECU for the period 1990 to

1994, and lays down the activities that will be funded, subject to the passage by co-operation procedure of the 15 specific programmes, whose scientific and technical objectives it describes in general terms. It also lays down the manner in which the programmes will be implemented, the selection criteria, the detailed rules for financial participation by the Community, and the rates, and establishes measures to disseminate the knowledge gained from and to exploit the results of the specific programmes. It fixes an evaluation of the programme's progress for the third year, an evaluation of the 1987-91 specific programmes and of the 1990-94 specific programmes once completed, and allows the submission of new proposals after the mid-term review.

As the Community is responsible, all significant materials concerning the research programmes will be available in English, researchers will be able to communicate more easily with non-anglophones, the work will be open to scrutiny by the UK MEPs, and by other parliamentary officials, and UK officials and/or experts will be directly involved in the work of management or supervisory committees of the specific programmes.

The examination of the initial proposal in the Parliament has shown up both strengths and the weaknesses of such programmes.

Though the programme is a Community one, the initial decision is made on the basis of article 130i of the EEC Treaty, and requires unanimity in Council according to article 130ql of that same title VI of the EEC Treaty. It is effectively an international agreement where all parties have to accept the terms of the decision, before there is any activity under the agreement. When participants determine the limits of their financial participation before the negotiations on the terms of the agreement, these limits can become limits that apply to all other participants, whether they wish it or not. Thus the financial ceiling may be determined without regard to the merits of the research proposed.

Moreover, because the initial decision is one requiring unanimity, the text agreed may lack the clarity and definition that could be achieved with majority voting. The tendency will be to include matters that will help towards a unanimous decision, whether those matters are real priorities in the Community as a whole or not. Thus the specific programme descriptions do not necessarily lay out research objectives whose successful attainment can be assessed.

As to the benefits of the framework programme, it allows the UK to participate in research activities that it could not undertake by itself, helping it to become more competitive, by for instance being one of the active participants in the standard setting that research frequently accomplishes, it extends the research experiences about which it is informed, it encourages researchers and industrialists to co-operate with other teams which might not have been considered without such a programme, it widens the training possibilities for the research community in the UK. Many of the specific programmes allow the participation of non-EC countries, which extends some of the benefits described above.

14 July 1990

Evidence from the Agricultural and Food Research Council

INTRODUCTION AND BACKGROUND

The organisation and scientific objectives of the Agricultural and Food Research Council (AFRC)

1. The Agricultural and Food Research Council was founded by Royal Charter to undertake research into agricultural and biological sciences. In 1990-91, the Council will receive £8.2 million from the Department of Education and Science, and £45.6 million from research commissions for the Ministry of Agriculture, Fisheries and Food (MAFF). AFRC's income amounts to about 2 per cent of total publicly funded research. Additionally, in 1990-91, income of some £16 million is expected to be earned from sources other than the DES and MAFF, such as industry and commerce, the European Commission and private foundations.

2. The primary aim of the AFRC is to provide the essential core of basic and strategic research, and the associated expertise and technology, needed to support biologically-based industries in the UK, especially agriculture and food. The Council's scientific programme seeks to ensure that the major opportunities offered by modern biology and biotechnology are grasped. The main scientific efforts within such objectives are set out in the Council's Corporate Plan (paragraph 4.4). They are:

- To increase the pervasiveness of molecular sciences.
- To advance basic knowledge of the physiology and biochemistry of whole organisms.
- To improve our understanding of the relationship between agriculture and the wider environment.

3. The AFRC funds seven major interdisciplinary Institutes which are national foci for research in their areas of responsibility (see Appendix 1 for details). They also have an important research training role with over 300 research students working within, or associated with, AFRC Institutes. AFRC is also responsible

for research, scholarship and training relevant to agriculture, food and the related sciences in higher education institutions. Currently, some 25 per cent of AFRC Science Budget funds are used to support scientific research in universities and polytechnics, and it is planned that this figure should rise to 30 per cent by 1994-95. The Council has three advisory Research Committees covering Plants and Environment, Animals, and Food which keep the scientific programmes under review.

The international policies of the AFRC

4. Science is international and the AFRC has consciously chosen to approach its research activities in a European and a wider international context. The current pace of intellectual advance is such that any funding body which wishes to remain at the "leading edge" has to ensure that its scientists keep fully in touch with developments throughout the world.

5. Council has recently reviewed its international activities and confirmed its objectives. They are:

- (i) To advance knowledge in agricultural, food and biological sciences through international collaboration which keeps UK universities and AFRC Institutes fully in touch with developments in other countries with high quality research communities.
- (ii) To establish the seven AFRC Institutes as European centres of excellence.
- (iii) To treble funding from the CE by 1993.
- (iv) To undertake selected research and training programmes with less developed countries.
- (v) To promote AFRC research, and to extend its sphere of influence in policy and programme formulation in Europe and beyond.

6. The main aim of AFRC activity in Europe is to strengthen and sustain bilateral links between AFRC Institutes and key research teams in the higher education sector, and the best European laboratories. France, Germany, the Netherlands and Spain have been identified as priority countries for the development of such links. Memoranda of Agreement have been signed with the Institut National de la Recherche Agronomique (INRA) and Centre National de Machinisme Agricole du Génie Rural des Eaux et des Forêts (CEMAGREF) in France, and a further agreement is likely to be signed with the Directorate of Agricultural Research (DLO) in the Netherlands later this year. These Memoranda are designed to provide a firm framework for the scientific review and monitoring of bilateral programmes and projects. They support joint research projects, exchange programmes, exchanges of data and research results and a range of other collaborative activities.

Advantages and disadvantages of joining ISPs (question i)

7. The range of international scientific programmes is very wide, and the reasons for participating also vary widely. The AFRC's experience is restricted to "small science" collaborations, but still covers a wide range of different types of collaborative programme. The main programmes in which the AFRC is involved are the European Community's R&D Framework Programme and the European Science Foundation. On a bilateral basis, the Council has a wide range of international programmes with France, Spain, the Netherlands, Australia and New Zealand (on biotechnology), and the American National Science Foundation (on mapping the *Arabidopsis* genome).

8. The rationale for AFRC participating in an ISP will generally be its capacity to deliver one of the objectives set out in paragraph 5 above. In particular, participation within an international programme is likely to be an effective way of keeping in touch with scientific developments in other countries (objective i) and, reciprocally, of promoting UK research capacities and extending the sphere of influence of UK science (objectives iv and v). Participation in the *Arabidopsis* project, for example, alongside the United States and a range of other European countries is geared to these objectives, as are the bilateral programmes with France, Spain, the Netherlands and Australia/New Zealand.

9. Linked to this rationale for involvement in ISPs are a range of other tactical and pragmatic factors. There are some research topics where international collaboration is valuable because it creates the large-scale *critical mass* of scientific expertise and/or funding which enables the necessary scientific advance to be made; this is a further reason for the *Arabidopsis* project. At a lower level of critical mass, the degree of *specialisation* in a particular area of science may be such as to justify international collaboration in order to bring together isolated scientists who, when working in partnership, will produce more valuable results.

10. International projects can also be advantageous in bringing together a range of widely *varying research milieux*. The study of the impact of climate change on agriculture, for example, can benefit from the incorporation into the research design of a number of different climate zones, thus permitting analogue comparisons to be made more successfully. A similar case can be made in relation to epidemiological studies where data from different sites can be used to isolate significant variables which can account for particular pathologies. Another pragmatic reason for participation in an ISP relates to research requiring *large-scale facilities*, where international contributions can create facilities which would be too expensive for any individual country. There is no obvious example of this sort of ISP in the AFRC domain, but an application of the same principle is the inclusion of AFRC Institutes in ISPs involving less developed countries because of the value to LDC scientists of access to AFRC facilities.

11. The disadvantages of participation in ISPs relate partly to cost factors, and partly to the problems of scientific and financial management. Because of the travel requirements involved in successfully

conducting an international collaborative scheme, and the obligation placed on the participating groups to keep each other informed of results and outputs, there are inevitably greater *co-ordination* and *mobility* costs than would normally occur in a purely national programme. The co-ordination requirements of ISPs can also spawn *over-complex management structures* and dysfunctional *bureaucratic procedures* which obstruct good science. National and international *political considerations* can often enter into decision-making, again to the detriment of the science. One example of this is the perceived bias in favour of “cohesion” at the expense of scientific quality in the selection of projects for funding within the EC Framework Programme. (Measures to improve Community “cohesion” are those which seek to correct imbalance in levels of R&D and scientific activity between member states). In collaboration projects, the least effective partner can have a detrimental effect on the course of the project; hence, the introduction of teams from weaker laboratories to meet EC policy requirements can reduce the value of the science bought with a particular volume of resources. Within the European Science Foundation too, scientific priorities can reflect personal initiatives of particular members rather than the rational outcomes of an responsive mode system that is equally open to all. The consequence of such political considerations entering into ISP decision-making is that valuable scientific time is lost in lobbying and seeking to ensure that the system works to produce acceptable scientific outcomes.

The advantages and disadvantages of hosting large facilities (question ii)

12. AFRC does not host or participate in large facilities such as JET or CERN. However, it does attach very considerable importance to the creation of large well-resourced laboratories in the United Kingdom as the basis for effective involvement in international science in contemporary conditions. The restructuring of the AFRC Institutes over the past few years has been explicitly planned to create high-quality facilities in which an internal critical mass of excellent scientists can make rapid scientific advances at an international level. Large, well-resourced facilities will also provide a more effective and attractive basis for the involvement of scientists from other countries. The AFRC strategy of developing European centres of excellence (Eurocentres) is based on a firm belief in the value of large facilities. In the current EC biotechnology programme, for example, the AFRC Institute of Animal Physiology and Genetics Research is co-ordinating a very large programme involving 16 laboratories in eight European countries; and the AFRC Institute of Plant Science Research is co-ordinating and participating in seven projects involving some 50 laboratories.

The machinery for establishing programmes, the technical and financial criteria and the decision to participate in ISPs (questions iii, iv, and v)

13. In the case of the European Commission's R&D Framework Programme, the process of decision-making on the content and size of the overall programme involves both scientific and political elements. The Commission initiate the process with a period of consultation with “experts” in the various fields. This consultation period, which is usually wide-ranging but not very systematic, leads to broad outline proposals from the Commission covering the scientific content of the programmes and the volume of resources to be requested. These proposals are discussed by the scientific advisory committee CREST and by the Council of Ministers. The Council decision on the size of the overall programme is essentially determined by political bargaining between member states as to an acceptable figure; there is no attempt to construct a global figure from assessments of the cost of individual scientific programmes designed to meet particular policy objectives. Once a global figure was agreed on Framework Programme 3, for example, the Commission simply reduced the proposed cost of each programme *pro rata* to the difference between the global amount proposed by the Commission and the sum agreed by the Council of Ministers.

14. The detailed scientific content of each programme line is subsequently elaborated by the Commission, and is then subjected to a detailed process of negotiation between the Commission and member-state representatives in expert groups. This process gives Commission officials an opportunity to exercise a considerable degree of influence over the drafting of proposals and subsequent amendments. Divisions and differences of emphasis between member states inevitably have the effect of increasing the degree of influence exercised by the Commission. The scientific content of individual programme lines is normally drafted in a sufficiently general way as to leave a wide margin for interpretive discretion by the Commission and the advisory committee (CGCs and CANs) when calls for research proposals are eventually made. Decisions at each stage are thus the product of a complex inter- and intra-organisational bargaining process.

15. AFRC considers that this process could be improved by two relatively simple procedural changes:

- (a) At this stage where the Commission is developing proposals for a new Framework Programme, information on a range of experts should be supplied to the Commission by member states (in the UK, by the Research Councils). This would go some way to ensure that the Commission was in a position to be more certain than it was drawing on a representative range of opinion.
- (b) The scientific objectives for each programme should be articulated in a much more coherent manner than at present. This process would make both the construction of the programme and its management more “transparent”.

16. Proposals for *European Science Foundation* programmes and networks are initiated by individual scientists or research teams. Proposals are reviewed by the relevant Standing Committee of the ESF or by

the Networks Committee and then by the Executive. Final formal approval rests with the Annual General Assembly. Since most ESF programmes are funded on an *à la carte* (voluntary) basis, the decision to participate then falls back upon each member organisation. In the UK, Research Councils meet within the UK ESF Committee to provide scientific briefing to the UK Executive Committee representatives, and at this point, any significant objections to particular programme proposals or comments on its content are recorded. Within AFRC, the decision to participate in an ESF programme is taken by the appropriate Research Committee in the light of its relevance to the AFRC's research programme.

17. Decisions by AFRC to establish a bilateral programme with a research council or a research organisation in another country, and to participate in multi-lateral programmes such as mapping the *Arabidopsis* genome or the Human Frontier Science Programme, are taken against the background of the Council's strategic policy objectives set out in paragraphs 2 and 5 above. Collaboration with the French Institut National de la Recherche Agronomique (INRA), for example, has been developed over a number of years in a highly targeted way, drawing on the two organisations' expertise in key areas of science. The decision to establish formal Memoranda of Agreements with INRA, and with the Dutch DLO, reflect a belief that a firmer framework of co-operation will assist in meeting mutual scientific objectives. Council, advised by its Research Committees, and its Management Board, will in each case assess the value for money of proposed international links as compared with purely domestic scientific programmes.

Government practice and guidelines on ISPs (question vi)

18. The guidelines produced by the Cabinet Office Science and Technology Secretariat provide a useful background and framework for AFRC international activity. They largely re-state the approach traditionally taken by the Council to evaluating proposals to participate in ISPs. Co-ordination of UK international scientific activity occurs through the Cabinet Office Sub-Committee on International Affairs.

Additionality and attribution (question vii)

19. The AFRC shares the general concern of the Research Councils about the effects of the system of attributing the costs of EC programmes to Government departments. Where the UK share of the costs of EC programmes is attributed to the Science Budget, it is open to the DES to seek compensation in the Public Expenditure Survey. To the extent that additional funds are not granted, and the Science Vote is consequently lower than it would otherwise have been, Research Councils are in practice obliged to reduce domestic programmes to fund the EC Framework. It may be the case that a higher scientific priority is attached to the domestic science that is displaced than to the EC programmes.

20. UK representatives are, of course, involved (as paras 13-15 make clear) in the process of discussion about the content of EC programmes. AFRC representatives, and colleagues from the other Research Councils, seeks to ensure the development of detailed proposals for each subject area that will result in a good use of funds. But neither the Research Councils, the ABRC, nor the DES have control over decisions on the total sums to be spent on programmes such as Biotechnology and Human Capital and Mobility, the UK share of which is funded wholly or partly from the Science Budget. This is essentially a political decision which emerges from the dialogue between the Commission and the Council of Ministers. Where UK representatives seek to resist pressures to increase the size of programmes they can often find themselves in an isolated position in doing so. Representatives of countries where the contribution to the EC budget is regarded as an entirely independent budget line, with no repercussions on individual domestic programmes, see an expanded EC programme as a means of gaining additional funding for the area of science for which they are responsible.

21. It could be argued that the Science Budget should only be used for the costs of international collaborations from which, on scientific grounds, the UK could withdraw. A commitment to payments from which it is not possible to withdraw on the basis of scientific assessment is an unprecedented use of the Science Budget. The priorities for its use have hitherto been determined by the UK scientific community, but this is no longer the case in relation to the proportion paid to Brussels. It is true that funds can be won back by British scientists, who do generally obtain a "*juste retour*", but this is not necessarily for support of work to which the UK scientific community would attach priority. If the attribution system is not to have a detrimental effect on British science, the Science Budget should be compensated for EC payments in each year's PES round. Alternatively, total public expenditure could be "top-sliced" in respect of the EC budget contribution prior to departmental allocations being made. This would allow domestic spending priorities to be assessed separately from EC budget considerations.

Impediments to ISPs (questions viii and ix)

22. AFRC has not experienced any significant impediments to engaging in international programmes. From the UK side, there is some resistance to spending lengthy periods in unfamiliar surroundings where English is not widely spoken (e.g., Japan). In relation to Eastern Europe, the lack of hard currency is a continuing brake on the integration of those scientific communities into wider international programmes.

Evidence from Dr G S G Beveridge, Vice-Chancellor, Queen's University of Belfast

(i) *The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions.*

The general advantage of participation is through networking, exposure to different cultures, participation in a wider sphere and in larger projects. There is a special advantage to Northern Ireland due to peripherality. The benefit to the funding institution is through access to centres of expertise and the creation of an international dimension to British science. A national advantage concerns the creation of recognition and goodwill for British science and the United Kingdom—which in return produces tangible (e.g., equipment export) and intangible benefits.

In regard to third world aid programmes there may well be increased geographical range and efficiency of aid or fund distribution by operating international programmes.

There are also some disadvantages. The funding body will almost certainly have less direct control over use of funds. For participants, there may well be very unequal gains, especially by developed countries when interacting with underdeveloped countries where the science research base is at a very low level. Participants from underdeveloped countries may assume that the high technology techniques and solutions used by their partners are the only way of doing things, often leading to unsuccessful attempts to introduce technology unsuitable to the present research/economic status of their own countries.

Overall, our researchers are strongly supportive of international scientific programmes and would like to see them increase in proportion to national programmes.

(ii) *The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution*

As the sophistication of science advances, it is inevitable that large research facilities will have to be centralised. It is essential that the UK should have its share of such facilities in order to maintain the science base in UK and to enhance our international standing. The secondary consequences of hosting technologically advanced facilities should not be underestimated.

Participating institutions and their researchers gain directly in scientific terms and also in credibility by involvement in internationally recognised centres of excellence.

(iii) *The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate*

The EC machinery is highly developed but in general this process depends upon the ease with which scientists can travel internationally. For many institutions in the UK the cost of travel is the over-riding constraint and in Northern Ireland, on the Western periphery of the EC, the problem is particularly inhibiting.

Experience related specifically to a recent project funded by Band-Aid has been that the machinery is often cumbersome and falls foul of the administrative procedure in each country.

(iv) *The technical and financial criteria under which proposals for ISPs are presented and considered*

There is concern that too little information is available concerning the UK delegates on the Committees which award these grants. Also their method of appointment is unclear.

A particular difficulty with EC twinning grants, under the Stimulation programme, is the requirement that staff appointed must be from a different member state than that of the laboratory appointing them. This seems to be a very restrictive practice and clearly involves additional travelling and accommodation expenses.

(v) *The forums in which the decision to participate in ISPs are normally reached*

These are thought to be inadequate for all interested parties to participate fully. They tend to favour established interests making it very difficult for new players to enter the field.

(vi) *Government practice and guidelines on ISPs—how they apply and how widely they are known and accepted*

There is a need to provide better information on the availability of international grants and on the procedures for applying for support.

Government practice on VAT and export credit is not always helpful.

In Northern Ireland we are particularly well placed to contrast the thoroughness and vigour with which Government agencies of the Republic of Ireland keep their Higher Education Institutions informed of ISPs, with the lack-lustre performance of DTI and Government in the UK.

(vii) *Treasury rules of additionality and attribution—how they apply in respect of ISPs and the Science Budget and how they treat inflow of foreign money*

There is widespread concern that funds, particularly those arising from EC programmes, are not always truly additional so far as the UK is concerned. There is a perception amongst researchers that the UK Government has a much greater propensity than those of the other member states with which we find ourselves in research consortia, to claw-back funds in other ways. There is, at the very least, a communications problem about the Government's attitude to additionality.

Additionality is the key to securing individual commitment by researchers to seek and obtain participation in international science programmes.

(viii) *Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions*

The major issue here is paperwork and bureaucracy. This is a burden and a major disincentive to participation.

(ix) *Impediments in other countries to their engaging in ISPs (EEC; Commonwealth; USA; Eastern bloc) e.g., concern with national benefit and protectionism, problems posed by national budgetary procedures*

None of our researchers had specific experience in this area. There seems to be a fairly philosophical view that there is not a great deal they can do about other countries' problems or bureaucracy and that participants must work within such constraints.

ANNEX

Queen's University is heavily involved in international research programmes of many kinds, including EC contracts with practically every country in the Community. There is also a great many collaborative research projects with industry. The views expressed above were provided by researchers drawing upon experiences of the following international programmes.

- (a) A NATO grant for collaboration with Munster (West Germany) and Des Moines (US) to support travel and subsistence over two years. This is a continuation of a previous grant.
- (b) An EC twinning grant for collaboration with Brussels (Belgium), Paris (France) and Rome (Italy) valued—£200K to support travel, subsistence and research assistance over three years.
- (c) British Council, Link Programme 1977-to date. This major link is between Queen's University and the University of Khartoum, Sudan. The primary objective has been to assist in the discussion, initiation and development in Sudan of selected research programmes in the important agricultural and food sectors. Annually an average of four exchange visits, two in each direction, for an average of three weeks (to Khartoum) and three months (in Belfast) have been undertaken.
- (b) Band Aid. Link with University of Khartoum to enable two postgraduate students to undertake joint split PhD studies in both universities.
- (c) Overseas Development Agency (ODA) funded projects through National Resources Institute for collaborative West Indian, Columbian, Australian and Third World countries, e.g., Sri Lanka on plant pathology.
- (d) Several small collaborative projects: the Netherlands, Pakistan, Mexico, Bangladesh and Japan on various projects in agricultural and food research, including food marketing.
- (e) Food linked agro-industrial research—Concerted Action Programme of EC on Productive Microbiological Modelling and Sensory Evaluation of Foods.

Letter to the Clerk from Prof. Colin Blakemore Waynflete Professor of Physiology, Oxford

I reply to your letter of 21 June. I think that there is rather little to say on behalf of this Department because we have few major connections with international scientific programmes.

Many members of staff collaborate with scientists overseas. In many cases the cost of these collaborations are borne from individual research grants held here or in the collaborating department. In some cases, exchange visits are funded by small "twinning grants", such as the grants that I hold from NATO and the International Brain Research Organisation for exchange visits between my group and the INSERM Unit in Lyon. In my experience, this form of support is very cheap and extremely valuable—a few hundred or thousand pounds per annum can pay for the basic costs of several trips between laboratories, with the science itself being funded by separate research grants.

Two members of staff, Drs. Ashley and Powell, have been collaborators and co-investigators on research grants from the US National Institutes of Health. These grants have brought quite generous funding for research into the Department and have included an element for travel to the participating American institution.

I believe that the only ISP proper that this Department has been involved with is the new Human Frontier Science Programme, from which I recently obtained a grant to link my group with four experimental groups and several theoreticians in Canada, the United States, Japan and France. I must say that my impression at this stage of the Human Frontier Science Programme is that it is in a state of bureaucratic chaos. It has taken two months of time-consuming paperwork and negotiation to get close to the payment of the grant (and I have now just discovered that the first year's grant will be paid in two six-monthly instalments, even though most of the money is intended to be spent on equipment, all of which is needed immediately!)

In principle, of course, the encouragement of international collaboration of science is to be applauded. In practice, I think that it has proved rather difficult to arrange major programmes for collaborations that do not end up being an administrative nightmare. In my view, and for my particular area of science (brain research) I still feel that most money is probably best spent in the form of committed grants to single laboratories. However, I see no reason why, within the EC, institutions from all member nations should not compete for single-laboratory grants from a central fund. If the standards of refereeing and judgment of applications could be maintained, I think that Britain has everything to gain from the establishment of a central EC scientific funding agency. Unfortunately, from my own experience, I believe that the standards of organisation and scientific judgement for existing international programmes have not been as consistently high as those of UK funding organisations.

Yours sincerely
Colin Blakemore

Letter to the Clerk from the Industrial Liaison Office, University of Bristol

In response to the House of Lords call for written evidence for the Science and Technology Committee, Sub-Committee II (International Scientific Programmes), the University of Bristol is pleased to submit the following:

- (i) The primary advantage of joining an ISP is, of course, the opportunity to cross-fertilise ideas and work to a common goal by the use of complementary scientific methods, knowledge and approaches. This allows the international team to witness and learn different techniques, and to apply the knowledge gained to improve future processes and analyses. A major concern to a University is the problem of safeguarding intellectual property especially when one is working with an international enterprise.
- (ii) At the University of Bristol most use is made of the International Scientific Programmes of the European Commission. For the purpose of this paper, and ignoring other international scientific opportunities presented by such organisations as NATO or by the UN family of international organisations, the machinery to set up an ISP relates to Bristol as follows:
 - A. *In house*: Notification of the chance to participate in an ISP is given either to individual members of staff concerned personally, or communicated to the wider University body by such publications as the Industrial Liaison Office's "European Community News", their regular broadsheet. A copy is enclosed for the Committee's interest.
 - B. *In the UK*: Regular contact is maintained both with appropriate government departments concerned and with the offices of the various research councils. In terms of the Commission's programme, their help and guidance is often more of a supplementary nature to that which is supplied by the European Commission.

Where government and research council departments come into their own is that they not only serve on the panels that shape European Commission R&D programmes, but are in a position to nominate external experts to develop EC R&D activities. Whilst Bristol is generally satisfied with their operation, what can be discouraging is the end of the decision-making process. UK members frequently do not deem it necessary to communicate to the wider research community why a particular programme has been adopted or why a particular person has been chosen to serve on a panel.
 - C. *At the Commission*: In conjunction with the process described above, the EC remains the most open and helpful source of advice if the University is to enter an ISP. Its counsel is always sought at an early stage regarding the feasibility of any project. Whilst every effort is made to obtain information in advance, poor communications about forthcoming opportunities can be a problem. Even worse is the political "see-saw" that is at the heart of EC research—whereby Member States seemingly have given financial approval for a programme only to have it almost immediately withdrawn.
- (iv) Financial considerations as to the suitability of entering an ISP are thoroughly examined by the University. European Commission programmes are challenging in that only a 20 per cent overhead is allowed on a Marginal Cost Contract. This compares unfavourably with, for example, UK Research Council sponsored schemes, where a traditional overhead of 40 per cent is now considered as the minimum acceptable. Therefore joining an ISP inevitably presents a dilemma to HE establishments such as Bristol. Whilst the University has the ability to work to

extend the frontiers of science for the benefit of mankind and welcomes the challenges the programmes of the European Commission afford, it does, in effect, subsidise EC R&D research. If there is no change in the 20 per cent overhead, sooner rather than later the University's financial well-being will dictate an end to European Commission ISP participation.

Apart from the Marginal Cost Contract 20 per cent dilemma, there is the perennial problem of having thoroughly costed a programme—and having been successful—then being confronted with a vastly cut-back budget which often jeopardises the viability of the research. This is due to the Commission rule of “dividing the cake” to serve all the Member States' political interests. The House of Lords' support to solve this problem would be appreciated.

Finally, as regards the technical criteria under which an ISP is considered, please refer to notes in response to Question iii, particularly Part B.

- (vi) To the best of the Industrial Liaison Office's European experience, no UK government guideline in relation to EC programmes is known. The only working party on EC finance set up in the UK was the group chaired by Professor Hanham, the Vice-Chancellor of the University of Lancaster.
- (vii) Major concerns to such institutions as Bristol, who have a good record in obtaining ISP support, are:
 1. Will continued success in attracting ISP support result in a reduction of the Treasury's/DES annual university grant?
 2. At the present time, when individual departments are assessed over a broad range of criteria as to their scientific excellence, is sufficient attention paid to departments' *success* in obtaining ISP support? This is especially relevant when a department can be judged to be of international excellence. It would be remiss of the judging authorities to overlook departments' participation in ISPs when making such decisions.
- (viii) EC R&D expenses, in terms of the individual, are adequate, although as stated in response to Question (i), commercial secrecy and intellectual property rights are of paramount concern. COCOM restrictions, with the present breaking of the new dawn over Europe, are of less and less hindrance.

Yours sincerely,
Graham Blythe
European Liaison Officer

Extract from a letter to the Chairman from Sir Hermann Bondi

As for responding to proposals for international scientific programmes, I see three weaknesses in the UK at present.

First, the slowness of governmental decision taking (e.g., the case of the Canadian radarsat), secondly the way the financial autonomy of the Research Councils means that on the one hand they largely take the risks of currency fluctuations in international ventures, on the other that they rarely get earmarked contributions towards politically desirable ventures that compete with other scientific work (the British Antarctic Survey is the only exception that comes to mind). On the Continent once an international arrangement is made, it generally no longer competes with national work. Third, our ways of doing things are rather less formal than is usual elsewhere, and this can lead to awkward situations.

Letter to the Clerk from Professor M Brady, Department of Engineering Science, University of Oxford

I have circulated your memo regarding the House of Lords Select Committee to my senior staff. As I am not hopeful of receiving comments from more than a couple of them by your deadline, here are my comments as Head of the Robotics Laboratory:

- (1) I distinguish ISPs that are based on projects (e.g., Esprit) and those based on people or equipment. Regarding the former, of which we are involved in five (four in Europe, one joint between Europe and the USA), the advantages are:
 - (a) Heightened sense of an intellectual community transcending national frontiers. This has been especially so in Europe where the Esprit Programme has forged effective links between universities, research labs and companies across the EEC. This has increased significantly my own sense of being European rather than British.
 - (b) Funding levels are high and advantageous at a time when the government is cutting back on national programmes (despite its claims to the contrary). Esprit pays overheads (typically 20 per cent).
 - (c) The UK benefits from the readier access to alternative ideas and technologies pertaining to the subject of the research.

Disadvantages are twofold:

- (d) Paperwork and administrative overheads. Esprit grants involve a lot of paperwork, vastly more than is required for a US contract or for an industrial/SERC grant. One is at the mercy of the contract principal investigator who can either shield researchers from the worst excesses and allow them time to work on the substance of the grant, or "involves" them, thereby decreasing their time for work.
- (e) Travel. One spends large amounts of time in departure lounges of European airports, or at least that's how it feels.

Regarding people and equipment:

We see only benefit of receiving people from abroad or evaluating equipment for overseas companies.

- (ii) Does not apply to me (but see Professor V Jones).
- (iii) My Esprit grants have been set up based on my personal knowledge of research workers and companies throughout Europe. Until recently, the SERC and DTI have been "transparent". Recently, there have been welcome signs that the DTI are becoming more pro-active. For example, assisting would-be grantees by:
 - (a) Maintaining a "marriage broker" register of companies and universities wishing to work on similar projects.
 - (b) Providing advice on how to complete some of the extraordinary forms one has to contend with.
 - (c) Providing small travel grants to prime the pump.
- (iv) Esprit has improved greatly over the last five years. The advanced information packs now describe funding opportunities and officials give briefings that are helpful.
- (v) Self-funded, *ad hoc* meetings with potentially interested parties, having first established contact and orientation by phone/fax.
- (vi) I am not aware of them.
- (vii) I am not aware of them (nor do I wish to be).
- (viii) See my response to (iii)—the up-front cost of travelling around Europe to set up a project, and the long lead times involved.
- (ix) The USA imposes restrictions on the export of technology to certain countries with which we have/desire links, e.g., India. These disincline me to enter collaboration with the USA, as I rate European technology in my field to be in advance of that in the USA.

I hope these remarks are helpful.

Yours ever

Michael Brady

Evidence from the British Coal Corporation

EXECUTIVE SUMMARY

British Coal has actively sought international funding for a range of coal R&D programmes. As a result of increasing commercial pressure on the Corporation and the importance of the environmental impact of energy use, international R&D programmes will become increasingly important.

There has been no participation in major International Scientific Programmes (ISPs) relevant to coal initiated by the UK or overseas governments, since no opportunities have arisen. Consideration should be given to expanding the government's role in this area.

The European Economic Community has provided valuable mechanisms for organising and funding major projects on coal R&D. British Coal has been an active participant at all levels in establishing and monitoring programmes and in executing work. Attempts to reduce the proportion of European Coal and Steel Community funding available for individual projects should be resisted.

Although it does not operate as a funding agency, the International Energy Agency provides a very important forum for initiating and organising multinational programmes on coal utilisation R&D.

The international programmes with which British Coal has been involved, for example, that regarding the development of Pressurised Fluidised Bed Combustion technology, have proved highly advantageous. In particular, acting as host site for the project provided an excellent opportunity for British Coal to obtain first-hand experience of the technology development and major project management. The reputation gained has in turn provided British Coal with the opportunity to establish further collaboration programmes on advanced power generation technologies.

1. *Introduction*

British Coal Corporation have, since their inception, undertaken a broad spectrum of R&D related to coal mining and coal utilisation, performed both to support their own business interests and to undertake work in the national interest. The Corporation's research programme is submitted each year for comment and approval to the Advisory Council on Research and Development (ACORD). In recent years the gross value of British Coal's programme has been of the order of £40m, this value being an order of magnitude greater than government expenditure on coal research, development and demonstration.

2. Over the past 20 years British Coal have actively sought financial contributions to their R&D programme from other parties in the UK and overseas.

3. As a result of the increasing commercial pressure being applied to the Corporation, there is a shift towards the application of R&D funds to shorter term objectives at the expense of funding longer term R&D. Against this background the Corporation, together with ACORD, are examining future funding of long-term coal-related R&D and a greater involvement in international projects will be one possibility examined.

4. The environmental issues associated with energy use are demanding increased attention and many of these issues have an international dimension. With this in mind the ability to undertake international programmes will be increasingly important since it is necessary to ensure a common international understanding of the problems and possible solutions.

5. This paper illustrates the ways in which the Corporation's Research Programme has operated in an international context with examples of specific projects undertaken. Against this background it then addresses the specific issues of interest to the Sub-Committee.

6. *International Collaborative R&D*

British Coal have been involved in a range of international projects associated with coal utilisation which have been initiated through a number of different routes. Descriptions of the nature of the collaborations are given below.

7. *Projects initiated by UK or other Governments*

- (i) In 1988 the Corporation's Coal Research Establishment (CRE) was invited to participate in a "personnel exchange" programme organised by the European Community—Japan Centre in Tokyo. This organisation set up by MITI, has the objective of improving relationships between the European Community and Japan by taking managers and research workers from Europe into the Japanese work environment. A CRE scientist visited Japan for three months and visited 18 organisations concerned with Energy Research. CRE was introduced to the scheme by the UK Department of Energy; all costs were met by the EC-Japan Centre
- (ii) The Walker-Hodel Memorandum of Understanding, signed in 1984, provided a vehicle for collaboration on energy R&D. British Coal, together with British Gas and CEBG, were involved in defining specific areas for collaboration with USDOE. British Coal undertook small programmes of collaborative work on materials for high temperature filters and catalytic upgrading of pyrolysis tars. No UK government funds were made available for project funding. On completion of the projects no new projects have been initiated under this arrangement.
- (iii) British Coal's Technical Department has been involved in an ongoing programme of collaboration with the Soviet Union. A bipartite working party was set up comprising representatives from the Soviet coal industry and representatives of both British Coal and UK mining equipment manufacturers. This working party agreed on a number of key topics and set up sub-groups to advance collaboration in these areas. The sub-groups have visited both countries and discussed detailed initiatives. It has to be said that the Soviet and UK aims are not identical. Because of lack of hard currency the Soviets seek collaboration by means of exchange of technology, whereas the UK side seeks to sell proven equipment to the Soviet Union. There has been no Government funding available.

8. *Projects initiated by British Coal*

British Coal have been active in encouraging and supporting the development and demonstration of clean coal technology. In the last 10 years, with the support of the government, a number of substantial pilot plant/demonstration programmes on coal utilisation have been undertaken. In order to ensure adequate scope of the programmes at minimum cost to the Corporation, successful attempts were made to involve funding from other UK parties and overseas organisations, including the United States Department of Energy. There are three principal examples of these programmes given below.

- (i) After the initial IEA-funded programme on the demonstration of Pressurised Fluidised Bed Combustion (PFBC) technology at Grimethorpe (see page 4) a further programme was undertaken between 1985 and 1989. The total cost of this programme was £32 million (at 1989

prices) and contributions to the programme were provided by:

	£m
British Coal	14.5
CEGB	14.5
US Dept. of Energy Electric Power Research Inst., USA	3
(ii) The above programme successfully demonstrated the PFBC technology and in 1989 a new programme to demonstrate the British Coal Topping Cycle, which offers the possibility of generating electricity from coal with an efficiency of 45 per cent, was designed by British Coal. The total programme cost is of the order of £18 million.	
(iii) Following the energy crisis in the early 1970s, the Coal Research Establishment undertook the successful development of a direct coal liquefaction process for the production of premium transport fuels (petroleum and diesel). This process is now being demonstrated on a 2.5 tonnes/day pilot plant at British Coal's Point of Ayr Coal Liquefaction Facility. The total cost of this project in out-turn prices will be approximately £35 million. Contributions to the programme cost are as follows:	

	£m
British Coal	16
Department of Energy	3
EEC	14
Ruhrkohle	2
AMOCO	0.7

British Coal's Technical Department have had technical agreements for many years with a number of countries including the USA and Australia. These agreements have provided for exchange of information and, on some occasions, exchange of specific technology. By and large these agreements have worked very well and continue to benefit both sides. Exchange of information also takes place on an *ad hoc* basis with appropriate organisations in France and Germany. From time to time there have been specific agreements with Eastern Bloc countries and also with China. Generally speaking the technology of these latter countries has little application in the West and the reliability of their equipment leaves much to be desired. On the other hand these countries have gained greatly from importing Western and in particular UK technology. The problem has always been provision of currency or some other reward mechanism. The liberalisation of Eastern Europe will provide a significant opportunity for UK manufacturers, but they will probably need Government or EEC assistance to realise the full potential. British Coal rarely benefit directly from these agreements. Indeed it could be said that British Coal are helping their competitors to introduce more modern technology with which these countries will be able to compete more successfully with British Coal. However, undoubtedly these countries themselves see British Coal as a vital catalyst to securing and implementing such agreements.

9. Projections initiated with the European Community

Since the inception of the European Coal and Steel Community (ECSC) Treaty, British Coal have been active in supporting the various European R&D programmes. The Corporation have undertaken a great number of projects—in 1989-90 approximately 100 projects with life-times of two to four years and with gross total value of £40 million were being undertaken. Although historically these have not been collaborative projects, each project should be seen as part of a collaborative Community programme. More recently Community rules have been adjusted so that multi-country participation is a prerequisite for funding in some areas of work.

There are two principal mechanisms for funding coal utilisation R&D in the Community. First, there are Community funds (derived from Government contributions to the Community) available through various Directorates (e.g., Directorate General Energy [DG17] and Directorate General R&D [DG12]: up to 40 per cent of the cost of a project can be made available from Community funds, further government funding from Community governments being restricted to an additional 9 per cent. Funding programmes with a usual duration of five years are designed in order to address particular requirements. It is important that industry as well as government officials are involved in the design of the content of the programmes. In the new DG17, THERMIE programme, some of the available funds have been set aside for "Targeted projects"—again industrial experts should be consulted in selecting these projects. In general it is felt that industrial involvement in consultation on programme content, and in selection and monitoring of projects could be improved. A current candidate for financial support from THERMIE is the programme for underground coal gasification. British Coal have undertaken feasibility studies in this area, but the timescale and cost are so long and so great that it is not possible for the Corporation in their current financial state to invest more money in this programme. Accordingly the Corporation have ceased work in this area. However, the Department of Energy, encouraged by British Coal, is part of an international application for funding from the THERMIE programme.

The second route by which "European" funds can be made available for coal utilisation R&D is through the ECSC. In this case funds are made available through a levy on coal and steel production in the Community. Funds are made available for R&D related to coal winning, coal utilisation, hygiene in the

mines, safety in mines, medicine, and ergonomics. The programme is administered by officials in DG17. Sixty per cent of the cost of a project is provided (with a limit on the contribution to overhead costs). British Coal are adequately represented in determining guidelines for the programme content and in selecting and monitoring projects. The latter activity is undertaken by "expert committees" on which individuals are invited to serve; these individuals are principally research workers drawn from major coal producers and R&D institutions and hence form a well informed infrastructure unit. The expert groups often meet at R&D centres where ECSC funded work is being performed thus allowing first hand examination and discussion of work programmes. This system operates extremely satisfactorily. There is a recent disturbing move within the Community, which is seeking to reduce the 60 per cent funding level to the 40 per cent level adopted in other Directorates. This is being resisted on the ground that the source of the funds is ultimately from the levy, not from general Community funds.

10. *IEA initiated projects*

The International Energy Agency (IEA) was established in the 1970s by the countries of the West to consider and promote ways in which dependency on Middle East oil could be minimised. Based in Paris, one of the prime areas for study has been the coal chain from mine to consumer. Because of this, and in view of British Coal's nationalised status, the Corporation have subscribed to a number of IEA activities over the years. In some cases membership of these "research clubs" has been jointly paid for with the Department of Energy, who have also subscribed independently to some agreements. Country by country membership varies depending on the subject of a particular research agreement, but across the range the UK has been, and continues to be, a prominent member.

Two major examples of research clubs are:

- (i) The collaborative development of pressurised fluidised bed combustion. In the late 1970s, under the auspices of the IEA, West Germany, USA, and the UK, agreed to fund a programme of large scale pilot studies at the Grimethorpe colliery near Barnsley. This is one of the clean coal technologies with low emissions of sulphur dioxide and nitrogen oxides which is now being commercialised in Sweden, Spain and the USA. After the IEA programme, work was continued by the CEBG and British Coal (see page 2). Without such early practical involvement, the UK would be very poorly placed either to understand (as an informed buyer) or develop clean coal technology for use with British coals.
- (ii) The setting up of IEA Coal Research. This activity is managed for the IEA by British Coal and is based in London. There are 13 subscribing states and approximately 30 staff are engaged on collating information on coal research worldwide and producing review reports on topics of specific interest to the members. These are widely regarded as valuable state-of-the-art guides, much used by those drafting policy. British Coal perceive a number of benefits from these involvements:
 - (a) Useful information regarding activities throughout the world is gained in a manner easy to assimilate for a modest cost (shared with the Department of Energy).
 - (b) Acting as managing agents gives good access to the facilities of IEA Coal Research and ensures full consideration is given to British Coal Corporation/UK requirements.
 - (c) The liaison through Executive and Technical Committees gives direct access to current thinking on coal and energy issues in the USA, Canada, Australia, West Germany, Japan, Denmark, Sweden, Finland, Netherlands, Italy, and Austria. Such knowledge improves British Coal's own programmes of research and has been useful in drafting policy and strategy papers.British Coal and the IEA are at this time undertaking a new initiative aimed at the evaluation and demonstration of the technologies for sequestration of CO₂ from flue gases and means of CO₂ storage and disposal.

11. *Conclusions*

There has been no participation in major ISPs initiated by UK or overseas Governments relevant to coal utilisation since no opportunities have arisen.

12. The European Community provides a very successful platform for supporting multi-national projects on coal utilisation R&D. The administrative system is well established and works smoothly; there are no problems relating to satisfying technical and financial criteria.

13. Other than the European Community, the most prominent forum for promoting international programmes on coal utilisation R&D is the International Energy Agency, although it does not operate as a funding agency.

14. British Coal are actively encouraging and participating in the development and deployment of clean coal technology. There are two international aspects in relation to these developments. First, the US Department of Energy has a substantial Clean Coal Technology programme with which close contact should be maintained. Second, much of the clean coal technology developed in the UK has wide application in reducing pollution associated with coal use in Eastern Europe.

15. International funding of environmental scientific programmes related to coal utilisation is likely to become more important. Although IEA is providing a facilitating role, for example in relation to the proposed carbon dioxide removal programme, there is a case for the UK Department of Energy becoming more active in attracting international funding for such projects.

16. Although British Coal's experience of international projects has been principally outside government funded ISPs, the following observations are made in relation to the issues raised in the Science and Technology Committee's invitation of 8 June 1990.

- (i) Advantages and disadvantages in joining ISPs.
 - (a) The contact with other institutions has benefited both technical and managerial staff in terms of exposure to a range of international perspectives on R&D.
 - (b) Operation as part of a jointly funded programme has allowed involvement in more extensive work programmes which in turn allow investigation of a wider range of technical options.
 - (c) A disadvantage is that it is sometimes necessary to compromise on the programme content in order to meet the particular needs of one partner with no clear benefits to the UK.
 - (d) Decisions on programme participation and content are sometimes made on political rather than technical considerations.
- (ii) Advantages in hosting large facilities.
 - (a) Since it is often the case that a high proportion of host country staff are employed, this provides a very wide experience base (first-hand experience of technology development is very often more useful than access to reported information).
 - (b) The presence of staff from foreign institutions brings extra experience and expertise into contact with a large number of UK scientists and engineers.
 - (c) There is the opportunity for a greater degree of project and programme management experience in locally based facilities. This experience can then be used to secure other collaborative programmes.
 - (d) There are potential advantages to UK equipment suppliers.
- (iii) The machinery whereby international programmes are set up.
 - (a) The Government has not been active in setting up ISPs on coal utilisation.
 - (b) The IEA provides a useful facility through which to determine the general requirements for R&D and the detailed programme definition.
 - (c) The European Community provides a sound system for establishing targeted programmes and the associated funding.
- (iv) Technical and financial criteria under which proposals for ISPs are presented and considered.
 - (a) It is often the case that proposals are judged not only on technical and financial merits, since politics is an important component of the equation. It is important for participants therefore to understand the advantage of the lobby system and the necessity to indulge in *quid pro quo* arrangements with other prospective participants.
- (v) Forums in which the decision to participate in ISPs is normally reached.
 - (a) In the case of the prospective European ISPs, much of the decision making is carried out in Brussels. UK organisations can be at a disadvantage if they are not well represented. Effort must be put into being involved in appropriate forums from their inception.
- (vi) Treasury rules of additionality and attribution.
 - (a) The Treasury rules of additionality do act as an impediment to European Community project funding. The current practice is that Government funds cannot be used in conjunction with funds from the European Coal and Steel Community. Since the ECSC funds are levied on the Coal and Steel industries, it would appear that, certainly for longer term research projects, a combination of ECSC and Government funding is appropriate.
- (vii) Impediments within the UK to engaging in ISPs.
 - (a) The low level of activity in Government funded ISPs is not a result of any impediments within the system. Experience in international collaborative programmes has shown that operation under IEA Implementing Agreements is a successful, well proven route.
 - (b) Intellectual Property Rights: these must be agreed before commencement of the project and can be avoided by confining ISPs to pre-competitive research.
 - (c) Currency fluctuations: Community funds are paid in ECUs and fluctuations can significantly affect the conversion into sterling in which all bills are paid. High inflation also makes financial planning difficult.
 - (d) Language: Although English is widely used in science and technology, nevertheless our national inability to converse in the language of others places the UK at a disadvantage.

Letter to the Clerk from BP

Dear Mr Walters,

I refer to your letter of 8 June to Mr Horton.

I now have pleasure in setting out below BP's comments on those issues raised by Sub-Committee II in relation to international scientific programmes where we are able to speak from direct experience.

I hope that this information will be helpful to the Sub-Committee.

Replies to the questions posed:

(i) *"The advantages and disadvantages in joining ISPs, to the UK, to the funding department and to the participating institution"*

We are not in a position to comment on aspects relating to the funding department or relating to the UK generally.

BP perceives a number of advantages and disadvantages in participation in ISPs sponsored by the EC.

Advantages

The main advantages are financial:

- (i) The subsidy from the EC which may amount to 50 per cent.
- (ii) The sharing of the remaining cost between the industrial collaborators in the research project.

The potential benefits of joining ISPs include:

- Giving companies an opportunity to gain experience in an area of technology in which they are becoming interested.
- Maintaining an awareness of an area of technology which does not have high priority for internal R&D funding.
- Minimising the financial risk by sharing the cost of research.
- Establishing working contacts with potential customers and companies with similar interests.

In many cases, the main benefit of collaborating in research programmes is that experience and understanding of a particular technology can be gained more quickly than if the companies had worked in isolation.

Some of the potentially most successful collaborations are where the industrial partners will interact in a vendor-customer relationship. One example is a project involving the development of polymer-based composite materials by BP and the use of these materials by our European partners in the production of demonstration components for aeroplanes. This enabled BP to establish links with potential customers at an early stage in the development programme. In these instances, the potential benefits of collaborating go far beyond the bounds of the successful commercialisation of the products of the R&D project.

Disadvantages

Most of the disadvantages of EC-sponsored research programmes relate to their administration.

The application forms are themselves complex documents which take a considerable length of time to complete and as they form the basis of the research contract with the EC, they must be completed with great care. It is recognised by the EC that preparation of a proposal may take up to two man-months.

There is an additional administrative burden on the lead contractor in the collaboration because they become responsible for collecting the information about expenditures by all of the collaborators and are responsible for reimbursing them when money is received from the EC. The lead contractor is also responsible for the preparation of regular progress reports on behalf of all of the partners.

None of the expenses incurred in the preparation of proposals or for the extra administration by the lead contractor are recoverable.

Entering into a collaborative programme funded by the EC reduces the freedom of action of the collaborators. As an example, in some technologies, patenting is not the normal means of protecting innovations. However, the EC stipulates that the results of its R&D programmes are made public, therefore patent cover has to be sought as a matter of course in projects which produce novel products or processes.

(iv) *"The technical and financial criteria under which proposals for ISPs are presented and considered"*

The decisions about funding proposals are taken in three stages by committees within the EC. In the first stage, the technical worth of the proposal is assessed by experts in the field from various member states. The list of selected projects is then passed to the programme committee with representatives from each of the member states of the EC. The final decision is made by the appropriate Directorate-General of the Commission. The proposals are considered within rigid cash constraints, and in many cases, the maximum funds per application are specified when the call for proposals is published. In some programmes, small and medium sized companies are more welcome applicants than multinational corporations.

The only technical consideration of proposals is during the first committee stage when the applications are reviewed without the nationality of the proposer being known. It seems that delays in the progress of applications occur when national interests come in to play in the later committee stages.

(vi) *"Government practice and guidelines of ISPs—how they apply and how widely they are known and accepted"*

BP is not aware of any Government guidelines on ISPs, however in the case of funding from the EC, the Government is very supportive of potential British applicants. There is a contact for each EC-sponsored R&D programme within the appropriate Ministry or Government agency, who gives assistance with the preparation and submission of grant applications. These contacts are also able to give detailed advice on suitable topics for R&D proposals within each programme, and to advise on the likelihood of success of a particular application.

The impression is that the Government is keen to ensure that Britain obtains its share of EC R&D funds.

(viii) *"Impediments within the UK to engaging in ISPs"*

BP is not aware of any impediments within the UK to participation in ISPs, indeed the Government is most helpful to potential applicants as described in the answer to point (vi) above.

Evidence from Brunel University

1. One of the principal advantages attached to UK participation in international scientific programmes is the access it provides for UK scientists to facilities and experimental equipment which are too expensive for the UK to afford independently. Particular examples of such facilities are CERN, the European Space Agency, the Anglo-Australian Observatory; the Institute Laue Lauegevin, Grenoble; the European Synchrotron Radiation facility.

2. In addition, a crucial advantage is the maintenance of the quality of scientific research by the co-operative and competitive aspects of collaborative programmes, and by the attraction of very high calibre staff.

3. The advantages of hosting large facilities in the UK are largely financial. Staff are usually paid internationally competitive salaries and spend accordingly within the region. CERN's current annual budget subscribed by the member states in proportion to GNP, amounts to about £300 million of which half is spent on staff salaries, a large fraction of which is in turn spent in the Geneva-Pays de Gex region. The effect on the local economy is significant, although not always to the advantage of local people. Prices may become inflated and some damage to morale is caused if, as at JET Culham for example, locally recruited staff do not enjoy the same salary level.

4. A large international laboratory supports a substantial infrastructure of service, but if established on a green field site, requires initial investment by the host country entailing such facilities as airports, roads, international schools, additional telephone exchanges, etc. However, the long term benefits of international research facilities should not be overshadowed by the need for initial investment.

5. EEC international scientific programmes are well publicised, but those of the UK government are focused mainly on science and are consequently less well known to engineers and technologists. More information about programmes relevant to engineers and technologists would be helpful. The opportunity to work with overseas companies whose response to proposals is rather speedier than UK companies is always welcome. The EC ruling which requires the participation of only one industrial partner is of significant assistance in participating in ISPs. The UK programmes require two industrial partners. This and other variations between the UK and the EC in respect of ISP participation should be eradicated to afford easier access for UK institutions.

6. The participation of the UK in overseas based ISPs is strongly inhibited by the payment rules imposed by the Treasury. For example, the CERN contribution is payable in Swiss francs which the Treasury incorporates in the estimates as an equivalent amount in pounds calculated at an approved exchange rate.

This process takes place 12-18 months before payment is made, and if the sum set aside is inadequate because of fluctuations in the exchange rate, or the use by the Treasury of an optimistic exchange rate, the SERC has to find the balance of the funding from within its own budget. This process is unacceptable to many researchers.

7. Engaging in ISPs with countries whose general salary levels are higher than in the UK is often impeded by the low level of funding. This is also true for countries with a lower fiscal status than the UK whose researchers, unless paid at international rates, cannot live in high cost countries.

8. Despite the problems often associated with ISPs researchers believe that it is important for the UK to participate in order to maintain its scientific base and to continue to retain high quality scientists in the UK.

Letter to the Clerk from Professor I R Cameron, MA, DM, FRCP, Principal of the United Medical and Dental Schools of Guy's and St Thomas's Hospitals

Dear Dr Walters

Herewith our submission on International Scientific Programmes (ISP) as invited in the CVCP letter of 15 June 1990 (ref N/90/128). The UMDS Research Liaison Officer has mentioned your help in advising us on a response, for which we are grateful.

There are two areas in which marginally our research activity is germane to the CVCP brief, namely, involvement in the EC and academic staff exchange.

On Europe, collaborative research projects are typically initiated and managed individually by UMDS staff with a named European partner(s), and funded through one of the EC Research Programmes. A major funding source was the EC Health Services and Avoidable Death programme. Total UMDS revenue was £1.7 million by the end of 1989, a substantial improvement on earlier years. We plan to take increasing advantage of the Third Framework Programme, mainly through publicity from our restructured Research Secretariat.

On academic staff exchange, we have a steady inflow of visitors from home and abroad (85 during 1989), and an outflow of UMDS staff. Usually these are uni-directional rather than exchange visits and vary in time from several weeks to twelve months. Again, they are initiated by individuals rather than centrally.

These are the two activities which are relevant to the CVCP request, both of them rather peripheral.

Yours sincerely

Professor I R Cameron

Principal

EUROPEAN ORGANISATION FOR NUCLEAR RESEARCH

Letter to the Clerk from the Director of Research of CERN

Dear Mr Walters,

I have been asked by our Director-General, Professor C Rubbia, to reply to your request for written evidence on matters which we feel are relevant to the work of the Sub-Committee, chaired by Lord Carver, to consider the manner in which the "United Kingdom responds to proposals for international scientific programmes".

In preparing our reply, we have addressed directly a number of the particular issues which you identified in your letter. However, for the most part, it has seemed to us more appropriate to comment more generally than the individual issues imply. Our response is formulated very much from the point of view of our own organisation, CERN, which is concerned with a very specific area of basic research, namely high energy particle physics. We believe nevertheless that it can be used as an example of what can be achieved in pure science and perhaps more widely, through international collaboration.

In the file which I enclose with this letter we have provided a number of reports on specific topics and have collected together various documents which we believe may be of help to the work of the sub-committee. The titles of these reports and documents are given in the two lists attached. Other information and comments are given below.

1. As the members of the sub-committee may know, CERN was founded by 14 European countries more than 35 years ago. It is acknowledged to be successful both scientifically and in terms of promoting international collaboration in science on a world-wide scale. It has brought together in common projects scientific talents from many different countries and, by pooling resources of

money and manpower, has made it possible for these countries to provide research facilities for their scientists which are highly competitive on a scale which would have been beyond the means of any one of the countries on its own. In practice CERN has enabled scientists in Europe to carry out research in particle physics at the frontier of the subject. It is recognised now as the premier laboratory in this field and scientists from many parts of the world including the USA, the USSR and Japan are involved in its research programme.

2. The United Kingdom has participated fully in CERN from the start and had considerable influence on the way the laboratory was set up and funded. British particle physicists make excellent use of the research facilities which CERN has to offer. They play a prominent role on peer review committees and other advisory bodies which help in determining the scientific programme of the laboratory and in formulating its long-term research strategy. In addition, British nationals are well represented on the CERN staff including the higher levels of laboratory management. Britain provides about 15 per cent of CERN's total annual budget.
3. There is no one mechanism for setting up international programmes in science. The process will vary from subject to subject and with the size of the programme and the financial commitments required. Also the procedures for approving and funding participation differ from one country to another. The system of peer review and the process of decision making via the Science and Engineering Research Council is, as far as we can judge, an appropriate mechanism within the United Kingdom for dealing with such matters at least at the scientific and technical levels. As regards higher levels of decision making where political, financial, scientific and industrial issues may well become intertwined, we do not feel we have the detailed knowledge of the internal procedures within the United Kingdom to provide a properly informed opinion.
4. It is our perception that on balance there are real advantages to hosting an international research laboratory such as CERN. These range from the cultural impact on the local community, the impact on local industry and the relative ease with which scientists in the host country can use the laboratory, to the simple fact that the staff spend the bulk of their salaries in the host country (or countries as in the case of CERN) and that contracts for the supply of services and equipment are more likely to be placed with the host state than with other countries unless a strict policy of "*juste retour*" applies. Such a policy does not apply in the case of CERN where contracts are normally let following competitive tendering in member state countries and are awarded to the firm making the lowest technically acceptable offer.
5. Participation in an ISP such as CERN inevitably involves a certain loss of national scientific sovereignty which some may feel to be unfortunate even in an area of activity as international as is modern-day science. It is also a fact that for many ISPs, and CERN is an example of this, financial contributions are fixed by international agreements and can involve long-term commitments which can be viewed as disadvantageous to the funding authorities in the participating countries. These drawbacks seem to us to be easily outweighed by the opportunities which international collaboration in research can open up.

I hope that our submission will be of use to the sub-committee. If there is further information you require or if we can be of help in any other way, please do not hesitate to contact me.

Yours sincerely,
J J Thresher
Director of Research

Evidence from CERN

A BRIEF OVERVIEW OF CERN AND ITS ACTIVITIES

1. Introduction

CERN—the European Laboratory For Particle Physics—(the acronym comes from an earlier French title —Conseil Européen pour la Recherche Nucléaire) straddles the French-Swiss border just west of the city of Geneva. It is one of the worlds largest scientific laboratories and is an excellent example of what can be achieved by international collaboration.

Fourteen Member States—Austria, Belgium, Denmark, the Federal Republic of Germany, France, Greece, Italy the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom—provide CERN's budget (859 million Swiss francs in 1990) in proportion to their national revenues. Currently Germany contributes 22 per cent to the budget, France 17 per cent, the UK 15 per cent, Italy 17 per cent and the other countries 29 per cent. The governing body of CERN is its Council where each of its Member States is represented and has one vote. It is this body which decides on the CERN budget and approves its scientific programme. Council delegates are responsible to the appropriate government ministries in their home countries and are appointed by them.

The Director General of CERN is responsible to Council for the management of the laboratory and its scientific programme. In deciding on the experiments to be carried out at CERN's facilities (high energy

particle accelerators), he is assisted by peer review committees, with members drawn mostly from the Member States, which judge the quality of the proposals for experiments submitted to CERN and make recommendations to him.

CERN's business is pure science in a field—Particle Physics—which probes the innermost constituents of matter to help find how our world and the Universe works.

Experiments with particles have deepened the understanding of nature's laws: matter and energy are two aspects of the same fundamental thing. Widely different phenomena such as electromagnetism and radioactivity have been found to have a common foundation. Researchers hope soon to include in this foundation other forces which hold the nucleus together, and which give rise to the many short lived particles now known to exist in nature.

At CERN accelerators have been built which concentrate large amounts of kinetic energy in the particles they accelerate. When this energy is released in a collision, it can materialise as new particles. Many of these decay rapidly, so they are not found in ordinary matter and their existence was unknown until recent years.

The collisions are arranged to take place inside detectors, which follow the flight of particles, identifying what formed them, what they in turn decay to, their energy, lifetime, and so on. In this way a picture of the cascade of particles is built up, and from this picture we try to find the underlying natural laws.

At CERN scientists are trying to recreate conditions that only exist naturally in the hearts of exploding stars and, once, at the birth of the Universe. They are trying to capture samples of such matter states and bring them to the laboratory bench for measurement.

2. *The birth and evolution of CERN*

In the war-ravaged Europe of the early 1950s, a far-sighted group of scientists and politicians envisioned a new approach to scientific research through the creation of a European scientific laboratory. Even then, it was clear that state-of-the-art science needed, in many areas, research facilities larger and more complex than most individual nations could afford. In this way a contribution would be made to restore Europe's leading role in basic science, so evident before 1939, and at the same time it would bring together people from countries which had been at war only a few years before.

By 1954, enough countries had agreed to the idea for work to begin on the undeveloped Meyrin site in Switzerland on a particle accelerator—a synchrocyclotron—to accelerate protons to 600 Mev. This was not an ambitious project, even by the modest standards of the time, but it got a research programme underway quickly and provided valuable experience.

In parallel CERN began to build a very powerful machine—the Proton Synchrotron (PS). This came into operation in November 1959 and for a time was the most powerful particle accelerator in the world supplying experiments with 28 Gev beams of protons. Over thirty years later, this machine remains the kingpin of CERN's unique system of interconnected accelerators. However, its main goal is no longer to provide particle beams directly to experiments. Most of the time it gives the particles (protons, antiprotons, electrons, positrons and ions) their first big boost of energy before feeding them to the newer and larger machines, where they are taken to even higher energies.

From 1971 to 1984, CERN used a new type of machine—the Intersecting Storage Rings (ISR)—built on an extension of the Meyrin site into neighbouring French territory. Two counter-rotating beams of protons previously accelerated in the PS were stored in two intertwined rings and brought into collision. As well as opening up a new frontier of physics, the ISR provided scientists with valuable experience in building and operating this kind of machine, showing in particular that big detectors surrounding the collision points were needed to intercept and untangle all the emerging debris.

To answer the questions that resulted, work began in the early seventies on a big new machine, the Super Proton Synchrotron (SPS). This produced its first 400 Gev beams in 1976, and was later upgraded to 450 Gev. To house this 7 kilometre ring, which was built about 50 metres below ground level, the CERN site was extended further into France the protons crossing and recrossing the international frontier on each SPS circuit.

Early in the life of the SPS programme, a group of physicists led by Prof. Carlo Rubbia proposed using it as a particle collider. To avoid having to build a second ring, the idea was to accelerate protons and their antimatter counterparts, antiprotons, in opposite directions around the same ring and then make them collide.

Antiprotons are rare—one is produced for every hundred thousand or so protons hitting a target, but the next step in physics required about a billion of them at once. This seemingly impossible task was achieved by a new technique—"stochastic cooling" invented by Simon van der Meer—which enabled the antiprotons to be controlled, accumulated and shaped into an intense beam.

In 1983, the idea paid off with the discovery of the $W^\pm$ and Z^0 particles—the carriers of the weak nuclear force—confirming an elegant theory uniting the description of this force with the well-understood picture of electricity and magnetism. The experimental confirmation of this combined “electroweak” theory is one of the great steps forward of twentieth-century physics. For the discovery of the $W^\pm$ and Z^0 particles and the development of stochastic cooling Carlo Rubbia and Simon van der Meer were awarded the Nobel Prize for Physics in 1984.

Science at this level needs foresight and planning. Even while the SPS proton—antiproton collider was moving towards its historic discovery, the plans for LEP (Large Electron Positron collider)—one of the world’s largest scientific machines—were being finalized and construction work started in September 1983. LEP, which was the largest civil engineering project in Europe before the Channel Tunnel, was finished on time and within the predicted budget envelope, it represents a fine example of the successful collaboration between CERN’s Member States. The research programme at LEP started in August 1989 and the official Inauguration Ceremony took place three months later on 13 November.

Within LEP, beams of electrons and their antimatter counterparts positrons circulate in opposite directions in a 27 kilometre underground ring. They are accelerated almost to the speed of light and are then made to collide. Four very large detectors, each the size of a four storey building, are positioned at the collision points to intercept, record and analyse the emerging fragments of matter. LEP offers physicists a research programme of unrivalled richness and variety; indeed only two months after the first collisions in LEP, CERN was able to announce an extremely important physics result—that the fundamental building blocks of Matter consist of only three families of particles.

An important feature of the way in which CERN has evolved is the extensive use it has made of existing facilities and infrastructure to develop and construct very cost effectively new accelerators for its user community. The construction of LEP was a particularly good example and, looking to the future, there is the possibility of doing this again by installing a second ring of magnets in the LEP tunnel to enable collisions between protons and protons to be studied at energies ten times higher than those which can be achieved today.

3. *CERN today*

Experiments at CERN are in general collaborative efforts carried out by teams of physicists and technical experts from Universities and Research Institutes in many different countries and from CERN itself. The design, construction and operation of each experiment is primarily the responsibility of the collaboration concerned. The various components of equipment which make up the particle detectors and associated data acquisition systems needed for the experiment are provided by the participating groups and funded from the money allocated to them by their local funding authorities. CERN as a participating institute generally provides resources for the experiments as well.

To design and to build CERN’s intricate machinery and to ensure its smooth operation, to play its part in helping to prepare, run, analyse and interpret the complex scientific experiments, and to carry out the myriad of tasks in such a large organisation, CERN employs over 3,000 people, encompassing a wide range of skills and trades—scientists, engineers, technicians, craftsmen, administrators, secretaries, workmen, etc.

CERN’s research programme, based on its unique range of large accelerators attracts scientists from the Member States and from further afield, for example, the United States of America, Japan, Canada, the Soviet Union, Poland, Hungary, Czechoslovakia, the People’s Republic of China, India, Israel. (While working at CERN, most of these visiting scientists are paid by their home universities or research institutes.) The international involvement in the four big experiments on the large electron-positron collider, LEP, provides the most striking example at CERN of scientific collaboration which transcends political differences.

The results are discussed in open scientific meetings and published in scientific journals which are always freely available. The aim is to improve our knowledge of the world around us and to increase our understanding of the evolution of the Universe by studying the underlying, basic constituents of matter and the forces which act between them and hence control them. It is pure science with no immediate technological or commercial objectives.

However, even in the short term, this research, with its stringent demands for accuracy and ultra-fast response, frequently pushed modern technology to the limit, providing a catalyst for technological innovation with important spin-off into other fields. New techniques emerge—scanners for medical diagnosis, radioactive tracers, ion implantation, superconductivity applications, etc. In the long term, this new knowledge could lead to technological innovations to benefit mankind. Electricity, X-rays, nuclear energy, semiconductors and lasers are just a few examples of laboratory discoveries from previous generations of research of this nature which quickly made their mark on technology and went on to become parts of our everyday world.

4. *CERN and Technology*

As noted above, the task of meeting the requirement of CERN's research programmes is at the limits of many technologies simultaneously: it can be as demanding as the most difficult space or military developments. Not only is the technology advanced, but there is in addition an overwhelming need for high reliability.

Almost all equipment bought by CERN comes from European industries. Frequently, however, CERN's needs are beyond anything that is commercially available—they require new developments at the "leading-edge" of technology. Therefore, the equipment is either designed by their own engineers or special development contracts are placed with industry. Whenever possible, the actual production is done by European industry.

CERN is an excellent shop window for industrial products: thousands of visitors from scientific teams spread the news of successful innovations. This is an advantage of the openness of basic research. CERN licenses its own designs to manufacturers, who sell them to other markets, and use them as a basis for further commercial developments. CERN does not patent its work.

Basic research and technology develop hand-in-hand. New techniques give rise to new research opportunities, and new research problems prompt the development of new technologies, which then find other applications and new markets. A recent survey in the United States of America shows that High Energy Physics has had a direct influence on the development of technologies which now produce as much as a quarter of the US gross national product. Some examples of world wide developments which have origins closely connected with or strongly influenced by High Energy Physics (HEP) are given in the Appendix.

5. *Concluding remarks*

In addition to pushing back the frontiers of knowledge, CERN plays a major role in promoting the quality of European science education through its contacts with universities and science institutes. Faculty members use CERN's facilities to carry out front-line research. Young scientists working at CERN may move on to other fields, however they learn during their time at CERN important new skills in team-work and project management in a truly international environment and gain valuable experience of the close interplay between science and technology and the continual search for innovative ideas and applications which are so necessary in modern life.

CERN's work also stimulates industry—a survey (Ref. 1) has shown that many of CERN's contractors (selected after invitation to tender) generate, as a result of their work for CERN, several Swiss francs of new business for each Swiss franc received from CERN.

CERN is probably the world's most cosmopolitan research establishment. Every year its success draws some 5,500 scientists and technical staff from all over the world to the Geneva region and here they work hand in hand despite political, religious or social differences. It has established Europe as the world leader in the field of Particle Physics and is a strong cultural force for the advance of knowledge through co-operation and collaboration.

II

The advantages and disadvantages of hosting International Science Programmes

The advantages and disadvantages of hosting an International Scientific Programme (ISP) can be examined from many viewpoints of which the scientific and financial aspects are the most important.

Many of the advantages to the host country of having a large international scientific facility are clear: the overall scientific and cultural activity of the country will be enhanced; scientists from the host state, particularly those within easy reach of the site, are able to benefit most easily from experience, competition and participation in research at the highest level; close proximity of a University Department to a large science facility allows participation by its staff in the programme with the minimum of disruption to cohesion and departmental efficiency; transport of both material and personnel can be both complex and expensive and in this the host state is in a happier situation than the other participating nations.

The Host State of an ISP has the important advantage of being able to influence the policy of the organisation right from the start. People in strategic positions who will have a major influence on shaping the programme are likely to come from countries which are involved at the beginning of the project. Countries which join later may find it more difficult to exert the same influence.

To quantify the financial advantages and disadvantages of hosting a large ISP is difficult without knowing the contributions and services provided by the host country. However a brief examination of how CERN's two host countries benefit from the presence of a major scientific project will show that definite trends emerge.

CERN is hosted by two countries, Switzerland and France. Agreements were signed between CERN and Switzerland in 1955 and between CERN and France in 1972 which covered the legal relationship between the international organisation and the Host States. There are indeed both advantages and disadvantages to hosting a large international scientific facility such as CERN however it is generally accepted that the advantages greatly outweigh the disadvantages.

In setting up an international organisation, contributions from the host states are required in a variety of ways which go well beyond those which come from non-host states. First of all the relationship between international organisations and their host countries need legal regulation. The more formal side of this relationship is normally dealt with by international conventions on privileges and immunities. Drawing on experience at CERN a typical list of such immunities and privileges granted by the host state might include the following:

1. Making land available on host state territory.
2. Granting immunities and privileges generally granted to intergovernmental organisations under international law.
3. Providing protection of the ISP's land and maintenance of order in the immediate vicinity.
4. Giving assistance of necessary police force to maintain order on ISP's site.
5. Arranging for provision of necessary public utility services to the ISP.
6. Guaranteeing inviolability of ISP official correspondence and all documents belonging to the ISP.
7. Granting exemption from direct and indirect taxation of ISP assets and income and property.
8. Granting exemption from custom duties and charges and sales taxes other than charges for services rendered in import or export of materials and equipment needed for its administration and scientific functions in accordance with the convention.
9. Granting of diplomatic privileges and immunities to certain ISP officials.
10. Granting to foreign ISP employees exemption from tax on salaries and emoluments, immigration restrictions. Also granting of currency exchange facilities, repatriation facilities and customs facilities as enjoyed by the officials of international organisations.

Clearly some of these items have financial implications for the Host State, for example, the exemption of the organisation from direct and indirect taxes and the granting of land.

Beyond this and the more formal aspect of privileges and immunities it has become the practice in Europe that Host States of international—and also other—organisations agree to create or support at their expense certain aspects of the infrastructure of the organisations by for example:

1. Assuming the costs of building an electricity network on the site.
2. Helping with the preparation of the site, i.e., drainage.
3. Providing a water network for the site.
4. Helping with the cost of construction of certain buildings.
5. Providing suitable educational facilities for the children of international staff.
6. Building an access road network to the site.
7. Installing a modern communications network, i.e., telephone, to the site.
8. Paying for the maintenance and renovation of infrastructure on a case by case basis.
9. Supplying electricity and water at special reduced prices, etc.

Such help may be looked upon as disadvantageous for the Host State but at the same time could be seen as investments in the overall technological infrastructure of the country. There is no doubt that the siting of an international scientific programme increases the administrative work load of the host state. There is a greater demand for work permits, residence permits, customs formalities, etc.

Another important point is that the children of foreign employees who have spent many years at an international scientific laboratory grow up and are educated in the host state and may very well wish to obtain the nationality of the state which they know rather than returning to a country with which they no longer have anything in common.

All the above-mentioned factors which have become common practice in European scientific projects certainly entail a contribution of resources, financial or otherwise, from the Host State and could in one way or another be regarded as disadvantages. However, they are normally amply compensated by the numerous advantages and benefits that the host state derives from the installation of an international scientific programme within its borders.

These advantages range from the political and scientific prestige which cannot be measured in financial terms to economically very valuable and interesting effects.

An international scientific programme draws a large number of highly qualified personnel to one region of the Host State. Here they live and spend, bringing significant benefits to the retail, housing, banking and leisure industries. CERN spends approximately 350 million Swiss Francs per year on salaries, the major proportion of which stays in the Host States. International Science Projects attract foreign visitors, be it for meetings and conferences, or be it, as in the case of CERN, for scientific work which can last for long periods. CERN plays host to some 5,500 visitors each year all of whom need meals, lodging, airline tickets, etc. Some may spend a few days at a time in the laboratory, others may stay for longer periods extending up to a few years. On average about 2,000 of these visitors are at CERN at any one time.

Another and arguably the most important financial advantage for the Host State develops out the fact that the commercial enterprises in the country, because of their geographic proximity and their better knowledge of the needs, practices and procedures of the international organisation have a much better chance of gaining a large share of contracts than their competitors from other Member States. This is true of normal contracts for the supply of industrial goods and for the fabrication and installation of scientific and technical equipment. Also if the programme involves setting up a new laboratory or expanding an existing one it will provide a boost to the local construction industry. However, it is in the field of maintenance and service contracts that the advantage of the Host State becomes most noticeable. Office cleaning, insurance, electricity, gas, water supply, industrial waste disposal, transport, secretarial help, vehicle servicing, telephones, telefax machines, gardening, cafeterias are just some examples of the myriad service contracts which are almost exclusively awarded to the host state. This is a well known phenomenon existing, at various degrees of intensity, in all European organisations in the field of science and research. For example at CERN approximately 55 per cent of the 400 million Swiss Francs annual materials budget is spent in the host states of France and Switzerland.

III

Impediments to various countries in participating in the CERN programme

EEC and Commonwealth countries have no difficulties in taking part in CERN experiments. All EEC countries, except Eire and Luxembourg are Member States of CERN and their scientists may participate in the CERN programme as of right. Scientists from several Commonwealth countries for example, India, Australia, Canada are currently involved in Research at CERN. The United States have participated in CERN's programmes since the inception of the laboratory in the 1950s. This had been a richly rewarding collaboration for both Europe and the US. There has never been an official agreement between CERN and the United States' government setting up precise guidelines for this collaboration but a series of informal agreements has kept the relationship as flexible as possible. It is interesting to note that there are now more American physicists using CERN than European physicists using US high energy physics laboratories.

There is a long tradition of co-operation between CERN and countries from the Eastern bloc. However, these countries have a major impediment in engaging in CERN projects which is the difficulty of raising hard currency. As regards participation in specific experiments, this difficulty is frequently overcome by these countries contributing "in kind" to the experiments—that is to say with personnel, raw materials or particular items of equipment. For example the iron for the magnets of three of the detectors for LEP came from the Soviet Union. The problem of hard currency also poses a problem for Eastern bloc countries who may wish to become Member States of CERN since the necessary contribution to the CERN budget must be paid in Swiss Francs. Nevertheless, several Eastern bloc countries have expressed an interest in becoming Member States amongst which Poland has recently been accepted as a new Member State and is expected to join the Organisation formally in July 1991.

In the past scientists from Eastern bloc countries had difficulties obtaining the documentation necessary to leave their countries. Happily this is now much less of a problem and in fact being admitted to France and Switzerland can pose more of a problem than leaving their own countries.

The COCOM restrictions obviously create difficulties for scientists from the Eastern bloc. Access to certain computers is denied to them and until very recently they were unable to purchase any modern computers which would have enabled them to analyse experimental data in their own countries. It was also impossible until recently to set up direct computer links between Eastern bloc countries and CERN and the scientists were unable to benefit from electronic mail networks.

With the political changes in Eastern Europe the COCOM restrictions are changing rapidly for some countries but for the USSR, Rumania and Bulgaria they still present a major impediment.

IV CERN and Education

The CERN Laboratory provides research facilities for the particle physicists of Europe and is an extension of the postgraduate university system. In addition to providing an academic interface with basic research, it has established a technological partnership with industry on a large scale which has been recognised as a model of excellence.

CERN was set up in the 1950s to provide European universities with apparatus for their research into high energy particle physics. The apparatus, large particle accelerators and detectors, was becoming too costly for individual European countries to provide yet it was, and still is, the principal means to see more deeply into the structure of matter.

The intention was that professors, lecturers and research staff from the physics departments of universities should come to CERN to do their experiments while retaining their role as teachers, researchers and administrators in their own departments at home. CERN has been very successful in making this possible and it has many of the educational attributes of a university postgraduate college. Like Imperial College London or MIT in the United States, CERN concentrates almost entirely on science and engineering.

Rather than the day to day contact with other disciplines that is such an important educational ingredient in the life of a university, CERN has the potent educational ingredient of the coming together of people from all over Europe, and other continents, to form teams in which nationality is subordinate to the common cause of research on a scale which no university, however prestigious, can attain. If there is to be a renaissance of European scientific thinking, this is certainly a prototype.

Like the science faculties of any universities, CERN seeks to encourage an interface with industry with a flow of technology in both directions. In CERN's case this is particularly well developed because of the complexity of the equipment and facilities needed for its research. The particle accelerators and detectors are on a scale where they must be treated as projects, designed and specified by engineers to be manufactured by industry. Because they require techniques and standards of excellence that are on the frontier of what is possible, the effect is to stimulate participating industries to excel.

As far as the UK is concerned, altogether some 20 departments from universities in the UK participate in particle physics at CERN. As many as 800 physicists, engineers and technicians from these departments are involved and more than half come to CERN as users for periods between a few months to two years to set up their experiments and to collect the results. They collaborate with research workers from other countries, of whom there are approximately 5,000, grouping into teams like the team of approximately 500 physicists who work on the DELPHI experiment, one of the four big experimental collaborations working on CERN's LEP collider. The groups involved in this collaboration come from Ames Lab (USA), Amsterdam NIKHEF, Athens University, Bergen University, Bologna University, Neils Bohr Institute Copenhagen, Cracow University, Dubna JINR, Genoa University, Helsinki University, Karlsruhe IEKP, Lisbon LIP, Liverpool University, Lund University, Milan University, Orsay LAL, Oslo University, Oxford University, Padua University, College de France, Rome INFN, Rutherford Appleton Lab, Saclay DPhPE, Santander University, Serpukhov IHEP, Stockholm University, Strasbourg University, Trieste INFN, Turin INFN, Uppsala University, Valencia University, Vienna Akademie, Warsaw University, Wuppertal University. Working in such large international collaborations gives not only a wide experience in science but also an invaluable training in team-work and management.

Thus CERN's most direct link with European universities is through the physics departments which are involved in particle physics (experimental and/or theoretical). CERN does not give degrees, but many physics doctoral students receive their data and inspiration from CERN. The arrangements for university staff and graduates to come to CERN constitute the Fellows and Associates Programme. In addition, students from many different engineering, computing and physics departments, including universities and polytechnics, come to CERN on sandwich courses or during the long-established summer student programme.

CERN organises a wide range of lectures, colloquia and seminars which anyone at CERN (visitors as well as staff) is welcome to attend. Also, CERN arranges Schools (at post-graduate level) in various parts of Europe—this started in the early 60s with the School of Physics, to which have been added the School of Computing and the CERN Accelerator School. Further details are given below.

On a less structured basis, CERN staff (and the staff of institutes collaborating with CERN) are happy to take advantage of other ways of communicating the excitement and the reality of the physics and the technology of particle physics, by giving lectures to school children, to members of universities not involved in the field and to the general public.

The Fellows and Associates Programme

The many physicists, engineers and technicians who come to CERN to participate in experiments are given the status of associate. In general they are paid by their home employer, although CERN has limited funds available to assist in certain cases. This scheme applies also to engineers and computer scientists of the appropriate level and to scientists who may not be directly involved in an experiment but who spend sabbatical leave at CERN.

In addition to the Associates, approximately 70 Fellowships are offered per year to enable young post-graduates to gain experience in research work in experimental or theoretical physics, or in advanced development work and related research in a broad range of the applied sciences and engineering. On average, some 16 per cent of the Fellowships go to UK nationals. Fellows normally stay for one or two years and half of them already have their Ph D's.

Experience shows that ex-Fellows find the time they spent at CERN an excellent springboard for a career which is not necessarily limited to their primary field of interest when they started at CERN. Through the diversity of the work and the opportunities for on the job training, many Fellows become involved in different fields of research or development which lead to a variety of careers in industry and research.

Students

CERN also offers approximately 60 appointments per year as technical students lasting from 6 to 12 months to students specialising in applied physics, electrical, electronic or mechanical engineering, mathematics or computing. The period at CERN is regarded by their home institutes as an obligatory part of their studies, as is the case for students enrolled on a typical sandwich course.

These students tend to be much appreciated when they work for industry after the end of their studies, because of the invaluable contact with the high technology and efficient management and project control techniques for which CERN is reputed.

British Universities and Polytechnics have always shown great interest in this scheme, to such an extent that on average 20 per cent of all successful applicants have come from a total of 22 different Higher Educational Institutes in the UK over the past five years.

Every summer 115 young people, who have completed at least three years of time study at university or advanced technical college, spend two or three months at CERN participating in its daily work. They are given a comprehensive lecture programme to introduce the wide range of activities at CERN, in particular experimental physics and techniques. They also visit the accelerators and experimental areas. Students from the UK represent on average 15 per cent of the total of these summer students.

Seminars colloquia and lectures

Fellows, Associates or students at CERN can benefit from the many seminars and colloquia organised by the permanent scientific community and by visiting scientists in many fields. Giving a talk at CERN is often an event not to be missed by scientists travelling in Europe from other continents. These seminars and colloquia are open to all interested staff and visitors to attend as are most of the lectures in the training programmes mentioned below.

Among these lectures, there is an Academic Training Programme with the aim to provide scientific staff with information not only about developments and progress in high-energy physics but also in related sciences other than those with which the Laboratory is directly concerned. Typically there may be as many as 80 lectures a year in this programme, half of which are given by lecturers from outside CERN. The programme includes a special series of lectures aimed at the large numbers of post-graduate students who necessarily spend a significant amount of time at CERN to carry out research for their thesis work.

There is also a series of courses and seminars in the Technical Training Programme designed to increase the efficiency of all members of CERN's permanent or non-permanent staff by giving them the opportunity to keep abreast of technical progress in the fields of interest to the Laboratory, to learn of new developments, especially in computing and advanced technology and to enhance co-operation between specialists in different fields. There are on average 20 courses each year for a total of about 2,500 man/days of training.

An example of a typical programme of talks as announced in the weekly CERN Bulletin is given in the attached annex together with the programmes for academic and technical training in 1990-91.

The CERN Schools of physics, computing and accelerators

CERN organises three Schools which usually last two weeks. They are each held annually in a different Member State and sometimes jointly with USA and USSR.

Two of the CERN Schools of Physics have been held in the UK; the first near Windermere in 1974 and the second at Pembroke College, Cambridge in 1982. CERN Schools of Physics have always been well attended by graduates from British Universities.

The first CERN Computing and Data Processing School was held in Italy in 1970. Similar Schools were held biennially until 1986 and are now held annually. The 1988 CERN School of Computing was held in the UK, at the Queen's College, Oxford in August 1988.

Each year there is also a CERN Accelerator School at either an introductory or advanced level. The most recent advanced school was held in 1989 in Uppsala and was attended by over a hundred engineers and physicists from universities and science laboratories from all over Europe. When possible, a different host country is chosen each year to improve the flow of knowledge within the Member States of CERN. The introductory school is often attended by engineers from industry who are interested in manufacturing equipment for CERN. At a recent such school there was a two day seminar devoted entirely to the interface with local high-technology industry. There are a surprising number of new small accelerators being constructed in Europe purely for medical or technological use and these Schools have been very popular among the industries and laboratories which build them. CERN Accelerator Schools have been held in the UK in September 1985 at Oxford and in April in Chester.

V

Opportunities at CERN for British industry

MARKET POTENTIAL

The CERN purchasing budget (excluding labour, services, electricity and water) is approximately 250 million Swiss francs per annum.

GENERAL POLICY

Encouragement of competition

At least three bids have to be obtained for all purchases.

Competition is limited to firms having manufacturing facilities within the fourteen CERN Member States, unless there are substantial price or technological advantages in favour of a non-Member State firm. All enquiries for supplies valued at over 50,000 Swiss francs are issued in or translated into English (an official language of CERN).

Adjudication rules

Orders are awarded to the firm whose tender is the lowest which satisfactorily complies with the technical and delivery requirements. To encourage State manufacturers located far from the CERN site, price comparisons are made on an Ex-Works basis for supply contracts. Refinements such as vendor analysis, supplier loyalty, etc., are not applied in the adjudication.

The tender form may include qualification criteria which eliminate firms not meeting the commercial or technical requirements for a particular enquiry. These criteria will be specific to the type of equipment required and may include considerations such as company turnover, technical experience and references, design facilities, design engineering support, etc.

INFORMATION FROM CERN

Forthcoming enquiries exceeding 200,000 Swiss francs are published on a triannual basis in an official document which may be obtained from:

British Overseas Trade Board
(European Trade Committee),
1 Victoria St.

LONDON SW1H 0ET

Telephone 071-215 5339

Telex 88 11 074 DTHQ

INFORMATION FROM INDUSTRY

Science & Engineering Research Council
Attention Mr M Bowthorpe

PO Box 18

SWINDON SN2 1ET

Telephone 0793 26222

Telex 44 94 66

Member States are encouraged to arrange exhibitions at CERN lasting from Tuesday to midday Friday (to the extent that they can be accommodated). The next British exhibition, organised by GAMBICA, will be in October 1988. GAMBICA's address is:

Attention Mr W Pickett

GAMBICA

8 Leicester Street

LONDON WC2H 7BN

Telephone 071-437 4901

Telex 26 35 36

Individual firms may request one-day exhibitions of their products at CERN. The contact person at CERN is Mr Mathieu Diraison, telephone Geneva (010 41 22) 83 4S 85.

Firms are invited to advertise in the journal CERN COURIER which is distributed to most leading scientific and higher educational institutions in the world. The contact person at CERN is Madam Micheline Falciola, Telephone Geneva (010 41 22) 83 41 03.

British industrial participation

Since 1955, British industry has furnished supplies to CERN for construction projects and for numerous experiments. The attached list of firms (Annex I) (not printed) with whom CERN has placed orders since January 1986, shows that British companies satisfy an impressive cross-section of CERN requirements ranging from semi-processed materials to more sophisticated scientific and data transmission equipment.

DOING BUSINESS WITH CERN

Purchasing structure

A Contracts Section handles purchasing requirements over 500,000 Swiss francs. A Purchasing Section has eight satellite Purchasing Offices which meet the daily buying needs of the technical Divisions and user groups from outside laboratories, conducting experiments at CERN. This Section serves a multitude of users within the 3,500 employees and many thousands of visitors, spread over a large site astride the Franco/Swiss border.

Technical contacts

In view of the often complex nature of CERN's requirements, all firms are strongly recommended to visit CERN or, at least, to establish close contact with the technical person in charge before submitting a tender.

Firms may wish to carry out a market survey at CERN for their range of products. British personnel at CERN who are willing to give advice are listed in Annex II (not printed).

JOINT VENTURES WITH CERN

Within the scope of high technology developments, CERN often has problems which can only be solved by enlisting the help of industry. A type of "joint venture" may be undertaken, in which CERN provides part of the specialised know-how in the hope that the industrial partner can eventually exploit it for potential wider applications.

Both CERN and its partner invest manpower and material resources to solve the problem. More recent examples of such ventures are: applied superconductivity (cryogenics and superconducting structures for magnets and radiofrequency cavities); a token-ring network for computer control of complex systems; the development of a knowledge based system (KBS) for fault diagnosis in control systems; increasing the speed of response of charged coupled devices (CCDs) for signal processing.

VI

British staff at CERN

Who are the CERN staff?

CERN is a physics laboratory, but most of the physics is done by people who are based at universities and institutes in their home country—CERN staff total 3,500 of whom only 100 are research physicists (3 per cent). CERN staff comprise engineers, applied physicists and computer scientists (22 per cent), technicians (35 per cent), manual workers (24 per cent), plus administration (16 per cent). The professional staff are recruited internationally (from the 14 Member States), lower graded staff being recruited primarily locally in France and Switzerland.

Who are the British staff?

There are at present 334 British staff at CERN, being 15 research physicists (4 per cent), 160 engineers, etc. (48 per cent), 85 technicians (26 per cent), 7 manual workers (2 per cent), and 67 (20 per cent) in administration.

Numbers of British staff at CERN, by category.

administration—67

manual workers—7

technicians—85

engineering/applied physics/computing—160

research physicists—15

What kind of work is done by the British staff?

Representative activities for many of these staff are given in the Annex.

The typical British staff member is not a physicist

He/she is an engineer or technician who could equally well have been involved with say the UKAEA or Plessey or ICL, or one of many smaller companies at the high tech end of the market.

UK-based physicists are actively involved in CERN

Over 500 members of staff of British universities and of the Rutherford Appleton Laboratory (RAL) are among the over 5,000 so-called Unpaid Associates who are engaged in CERN experiments, and many of these people spend many months at CERN during preparations for and running of experiments. CERN exists to provide research facilities for this user community. Members of the user community come to CERN on secondment from (and paid by) their home employer, while CERN staff are directly employed by CERN.

CERN staff and industry

CERN staff are involved in a wide range of advanced technologies, in a laboratory which is a unique mix of industry and university in an international environment. CERN has excellent contacts with the university physics community, while relations with industry are less structured. Past and present contacts between CERN staff (of all nationalities) and industry show considerable two-way benefits from this interchange. CERN is eager to build on this.

ANNEX WHAT BRITISH STAFF DO AT CERN

This annex lists sample activities for British staff at CERN and covers about half the population. Most entries refer to the work of individuals, although some (e.g., electronics design, secretary, experimental particle physics) concern several people. (The classification by field for engineers and technicians is to facilitate understanding, and is not exclusive).

Research Physicists

1. Theoretical particle physics
2. Experimental particle physics

Engineers/applied physicists/computer scientists

Electrical engineering/electronics

1. Electrical distribution
2. RF and electron guns
3. RF design, fibre optic systems
4. Power converter design
5. Electrical engineering (high current, high pulse, and high voltage)
6. Digital control of RF systems
7. Accelerator control and operation
8. Telecommunications and computer networking
9. Coaxial line feeds
10. Computer/microprocessor control of particle beams and detectors
11. Monitoring and systems control using VME, G64, CAMAC
12. Electronics design (including FASTBUS)
13. Microprocessors, VMEbus
14. Telephone, telex, telefax systems

Mechanical engineering

1. Co-ordination of mechanical workshops
2. Specialised mechanical studies
3. Transport by air bearings

Materials science

1. Surface studies via electron microscopy, desorption, cleaning of vacuum chambers
2. Measurement of gas ionisation and electron absorption
3. Chemical safety and pollution control
4. Surface treatment and cladding (for 27 km of vacuum chambers)
5. Ceramics, insulation materials
6. Radiation protection

Applied physics/general engineering

1. Project management
2. Design of highly radioactive equipment
3. LEP vacuum system (27 km)
4. High refractive index photodetector (BGO)
5. Ring Imaging Cerenkov Detector (RICH)
6. Silicon microstrip detectors
7. Cryogenics for superconducting magnets
8. Automation of gas supplies using microprocessor controls and LNs
9. Gas supply system installation
10. Process control
11. Cooling and ventilation systems, smoke control
12. Health and safety
13. Man-machine interface hardware and software
14. Theoretical beam dynamics and machine performance
15. New accelerator techniques

Computing

1. Writing software utilities
2. VAX and microVAX systems software development
3. Database for LEP machine installation
4. Database co-ordination and development
5. Graphical presentation of process controls
6. Graphics support for CAD
7. Software support for electronics engineering
8. Computer user support
9. Computer interfaces and high performance special processors
10. Data handling for physics analysis

Technicians**Electrical engineering/electronics**

1. Microprocessor-controlled power converters
2. Electronics for beam monitoring
3. Pulse and digital electronics
4. Telephone, TV, radio communications

Mechanical engineering

1. Mechanical engineering safety aspects of new projects
2. Mechanical development work

Materials science

1. Material evaluation, failure analysis, electron microscopy
2. Lead cladding for vacuum chambers

Applied physics/general engineering

1. Cryogenics refrigeration and superconducting magnet testing
2. Magnet measuring equipment
3. Vacuum hardware
4. Vacuum testing of cryostat and RF cavities
5. Radiation monitoring
6. Silicon microstrip detectors
7. Supply of liquid nitrogen, helium
8. Safety inspection of lifts, cranes

Computing

1. CAD for magnets
2. CAD in drawing office
3. Index switching system maintenance

Manual workers

1. Sheet metal work
2. Welding
3. Goods reception
4. Photos' and audio-visual aids
5. Fireman

Administration

1. Secretary
2. Typing/text processing

3. Personnel management
4. Manpower planning
5. Social affairs
6. Translation
7. Language teaching
8. Library
9. Scientific information
10. Publications
11. Accounting
12. Public relations (visits)
13. Purchasing
14. Logistics management
15. Organisation and methods
16. Management information systems

**Letter to the Clerk from the Chief Executive of the
Centre for Exploitation of Science and Technology**

Dear Mr Walters,

Thank you for your letter of 8 June 1990. CEST has two comments on the matters within your terms of reference.

Most ISP's seem to be established through scientist to scientist collaboration and discussions. The concern should be that such arrangements take little note of future industrial exploration possibilities. Work undertaken by CEST supports the view that scientists have difficulty in identifying exploitable aspects of their research programmes.

CEST distinguishes between exploitation and application of scientific research. Exploitation being concerned with commercial applications which take place in industry.

The second comment is concerned with the involvement of UK industrial companies in ISP's where non-UK academic institutes are involved. It seems that UK companies have difficulty in identifying appropriate collaboration with such institutions.

Many of the topics listed in your letter, concerned, for example, with detailed science Budget and Treasury rules, are topics upon which we do not feel able to comment.

If you have any further questions, please do not hesitate to contact me.

Yours sincerely
Dr R C Whelan
Chief Executive

Letter to the Clerk from Dr P D B Collins, Dean of the Faculty of Science, University of Durham

Dear Sir,

In response to your request for evidence concerning the way in which the United Kingdom responds to proposals for international scientific programmes, members of my Faculty have made the following points (in your numbering system).

- (i) The obvious advantage of joining an ISP is that it makes possible research funding and the provision of facilities on a scale which no single country can afford on its own (e.g., CERN, ILL, ESA, etc.). It also brings together a larger ("supercritical") pool of talent, and fosters collaboration and hence mutual understanding. ISP's are now essential for "big science". The main disadvantages are the excessive bureaucracy and paperwork involved which greatly increases the overheads and can waste valuable manpower. Also commitments for big science ISP's can be at the expense of the national funding of "small science" and of the less fashionable subject areas.
- (ii) Advantages of hosting ISP's include an increase in the international awareness and prestige of UK research and a heightened impact of that research within the UK. However, if the domestic support and the local infrastructure are inadequate, the impression of "penny pinching" can be counter-productive, both for the reputation of British science abroad and through the unfair burden it places on domestic researchers in the field.
- (iii) In the past the call for proposals under EEC funded schemes has often left little time for those not "in the know" to put together project teams. This has improved of late, particularly since ESPRIT, BRITE/EURAM, etc., have now been running for some years. The efforts made by the DTI to establish contact points for and disseminate information on EC programmes are to be commended.

- (iv) In the EC context while technical and financial scrutiny is carried out meticulously there is still an impression that political considerations play a part. We are aware of applicants who expect their government officials to lobby in support of their proposals. We believe that the UK does not indulge in this practice. An enormous amount of effort can go into preparing an application only to find that a competing proposal is more acceptable politically.
- (v) for EC proposals these forums are informal academic/industrial groupings that derive from the personal contacts of consortium members. The EC uses a system of "expressions" of interest that is intended to bring prospective partners together. In our experience this has been less successful. Substantial travel funds are often needed to develop a proposal. The SERC's scheme is only of limited help for this purpose. But once such a collaboration has been achieved the resulting network of contacts makes future ventures easier to establish.
- (vi) We are not aware of any particular guidelines on ISP's but the DTI's efforts to promote participation in EEC schemes are commendable. The three Conservation bodies in England, Scotland and Wales will need to work closely together if we are to remain a force on the world scene in this area.
- (vii) The Treasury rules are matters of the greatest concern to the academic community because the demands of ISPs have adversely affected the support for domestic programmes across the whole range of science and technology. The "many" feel that they are suffering for the benefit of the "few" and such tension is counter-productive to the healthy development of collaborative scientific and technological research. The Committee is urged to exert pressure on the Treasury to provide separate funds for ISPs which involve treaty commitments and the domestic science programme.
- (viii) To the extent that any new major ISPs eat further into the domestic budget there is a major barrier in the way of such developments. Currency fluctuations have had a major impact in this area in the past and probably will in the future. The question of IPR is becoming a problem for academic institutions. While a proper return from IPR generated in a University is desirable this is often impossible to assess at the outset of collaborative projects. Too rigid a position by either the academic or the industrial managements can be a major impediment to the establishment of both international and domestic collaborative projects.
- (xi) National ambitions are undoubtedly an inhibition to some forms of wider collaboration on ISPs, though big sciences like particle physics and astronomy have a good record of overcoming them. Also international and intercontinental competition can still be a spur to greater efforts and achievement.

I hope that these comments may be of interest to your Select Committee.

Yours faithfully,
P D B Collins
Dean of the Faculty of Science

**Letter to the Clerk from
Andrew Dawson, Lecturer in the Department of Civil Engineering, University of Nottingham**

Dear Sir,

With reference to the letter addressed to Sir Edward Parke by R H Walters dated 8 June, I have the following comments regarding EC-sponsored scientific programmes.

We come across the following problems:

- Closing dates are usually given with insufficient notice for a considered bid for funding to be made.
- The short bid period necessitates pre-existing developed contacts with organisations in other countries. Collaboration with industry in another country is particularly difficult (although particularly desirable). Funds are seldom available to develop contacts in the absence of a place on a programme . . . Catch 22!
- Applications are unduly weighed towards administrative items. I have completed 50 page forms of which I was limited to 2 pages to make a technical case.
- When embarking on a contract with 100 per cent additional costs being met, full-time, permanent staff costs cannot be claimed. Mechanisms to deal with 50 per cent contracts are difficult in a University Environment.
- Notice to attend meetings in Brussels can be as little as 22 hours.

I trust these comments are of use.

Yours faithfully
Andrew Dawson
Lecturer

**Supplementary Evidence from Department of Education and Science
on UK Membership of the European Synchrotron Radiation Facility (ESRF)**

BACKGROUND

1. The initial proposal for the ESRF—now under construction in Grenoble alongside the site of the Institut Laue Langevin (ILL)—was contained in a May 1979 report from the European Science Foundation (ESF). That report recommended that a feasibility study into the construction of a powerful synchrotron facility should be carried out.

2. More detailed work on this recommendation was pursued in the early 1980s, leading to the signing on 10 December 1985 of a Memorandum of Understanding (MOU) by the Governments of France, the Federal Republic of Germany (FRG) and the UK. The Governments of Italy and Spain became parties to the MOU in 1986.

3. The MOU provided a basis for the detailed design work of the ESRF to be carried forward through a feasibility study. At this wholly scientific stage, an ESRF Foundation Phase Council was set up by the MOU, charged with establishing the Foundation Phase Team; monitoring the Foundation Phase Report; and preparing the legal texts necessary for the construction and operation of the ESRF. The SERC, being the Council with leading scientific responsibility in this field, participated for the UK.

DES and Government involvement

4. Once the focus of ESRF discussions moved from scientific aspects to issues of policy and finance, ministers and officials in DES (and other appropriate Government Departments) became more closely involved.

5. The report of the feasibility study was submitted to Ministers in each of the Member States in June 1987 by the ESRF Director-General, Professor Ruprecht Haensel. For the UK, this was sent to Mr Robert Jackson MP, then DES Parliamentary Under-Secretary of State responsible for science matters.

6. In October 1987, M Aigrain (Chairman, ESRF Foundation Phase Council) wrote to the then Secretary of State for Education and Science, Mr Kenneth Baker MP, advising him of the outcome of his Council's work and inviting UK signature of the ESRF Protocol that would permit the facility's construction phase from January 1988.

7. Over the subsequent months, detailed consideration of both the principle and level of UK participation in the ESRF was undertaken at both Ministerial and official level.

8. Mr Jackson met the ESRF Director-General in September 1987; and the Government's then Chief Scientific Officer Mr (now Sir) John Fairclough in October 1987.

9. In parallel, a working group of officials from the Government departments involved (DES, FCO, Cabinet Office, and HM Treasury) and SERC met and corresponded regularly to ensure that views were co-ordinated during negotiations on the level of the UK contribution both within the ESRF Council and with officials in other Member States.

10. As a result of these discussions, SERC tendered advice to the Secretary of State, Mr Baker, that the UK should participate in the ESRF at a suggested level of 10 per cent.

11. After consultation with appropriate Ministerial colleagues and with the Chief Scientific Adviser, Mr Baker endorsed UK participation in ESRF on 14 December at the proposed level of a 10 per cent share of the construction costs (and subsequent operational costs). Further negotiations then followed in the light of offers of financial support from other potential participating countries.

12. As part of these, Mr Jackson met his counterparts in France (M Valade) and FRG (Dr Riesenhuber) in February 1988. Having regard to the likely level of usage of the facility by UK scientists, and the prospective contributions of others, agreement was eventually reached under which the UK would contribute 13 per cent during the ESRF construction phase and 14 per cent in the operational phase. (The subsequent accession to ESRF by Belgium has reduced the required UK contribution in the construction phase to 12½ per cent).

13. The ESRF Convention and Statutes, finalising these arrangements, were formally signed in Paris on 16 December 1988, Mr Robert Jackson signing on behalf of the UK Government.

Evidence from the Department of the Environment

1. As explained in the Annual Review of Government Funded R&D, DOE sponsors research to inform current Ministerial decisions, guide the execution of policy, to monitor the achievement of environmental goals, to address issues on which Ministers may need to take decisions in the future, and sponsors collaborative research to underpin construction and pollution abatement technologies where the work would not have been undertaken by industry alone.

2. It follows that DOE takes part in international scientific programmes where these make a cost-effective contribution to policy goals—we are not primarily concerned with international programmes whose sole aim is the advancement of science. DOE is involved both in general programmes of a voluntary nature and in programmes to which we subscribe by virtue of membership of the parent organisation (this particularly applies to European Community programmes).

General International Programmes

3. The advantages to be gained from DOE involvement in international scientific programmes can be categorised as follows (though the categories are not mutually exclusive):

- (i) Direct link with international environmental action where the body organising the research has such responsibilities (e.g., UNECE Long Range Transboundary Air Pollution Convention).
- (ii) Access to the results of others which can be a very cost-effective way of improving the science base of policy (e.g., OECD Chemicals Programme, the EUROTRAC project on atmospheric chemistry).
- (iii) Contents of the programme may complement work carried out in the UK (e.g., work on underground radioactive waste disposal in the Stripa project).

4. DOE has encountered no particular disadvantages of international scientific programmes beyond the usual ones of multiple (and sometimes conflicting) objectives, extra resources of time and money needed for central management and co-ordination, the variable quality of that co-ordination, and difficulties in obtaining direct access to research results and common protocols for their analysis and interpretation.

5. There is no easy solution to these problems nor is there one international organisation that consistently performs better than others: the critical factors are the commitment and abilities of the central co-ordinator/manager and the commitment of the participants in the programme. All these possible disadvantages are weighed against the advantages in deciding whether to participate (or what priority to allocate to participation) in particular international programmes. On type of programme, the Department's experience has been that co-ordination of self- or nationally-funded research often has advantages of cost-effectiveness and commitment over centrally-funded programmes.

European Community Research

6. The Department leads for the UK on two EC research programmes: Environment and Climatology (current programmes STEP and EPOCH, duration 1989-1992, total funding 75 million ecu and 40 mecu respectively); and Radioactive Waste Management (current programme total 79.6 mecu over the period 1990-1994).

7. Participation in EC programmes is of course mandatory under the Single European Act. While the considerations above therefore cannot be used to decide whether to participate, many of them still apply to the science content of EC programmes (e.g., they may complement our own work and/or feed into policy development).

8. However, it is our view that Member States do not yet have sufficient weight in the management procedures for these programmes to ensure that they are formulated and managed for their optimal benefit. We will be pressing for a more executive role for the representative committees concerned.

The Department's Contribution

9. The Department has also taken a number of initiatives on international environment protection science. For example, the new Hadley Centre for Climate Prediction and Research, based on the Meteorological Office, is explicitly intended to act as an international focus for research in this field. Its aim is to be a major centre of excellence at international level and actively to encourage the involvement of scientists from developing countries to contribute knowledge of their own parts of the world to tackling the climate modelling problem. The Department was instrumental in establishing the EC/EFTA Task Group for the co-ordination of research on stratospheric ozone, which is based in Cambridge and provides the effective European focus (previously lacking) for this research. We have also, in co-operation with programme co-ordinators in the USA and the European Commission, established at Nottingham University the co-ordination centre for the air pollution effects project of the United Nations Economic Commission for Europe.

10. Although not strictly within the terms of this enquiry it is worth noting the extent to which the Department's own programme of research is linked to international policy developments and complements international programmes. Particular examples include North Sea research and almost all of the Air Quality and Global Atmosphere programmes.

Evidence from The Department of Health

The International scientific programmes in which the Department is engaged all fall within the European Community's R&D Framework Programme. The researching programmes are:

- The Advanced Informatics in Medicine (AIM) Programme.
- The Radiation Protection Programme.
- The Medical and Health Programme.
- The Human Genome Analysis Programme.

The Department of Education and Science through the Medical Research Council has the UK lead in both the Medical and Health Research Programme and the Human Genome Analysis Programme. The MRC, whose comments are endorsed by DH, are incorporating evidence in respect of both these programmes in their written submission to the House of Lords.

The Department of Health's evidence is in respect of the two research programmes where we take the UK lead, namely the AIM and Radiation Protection programmes.

Due to the diverse nature of the two programmes, written evidence covering the issues raised in the House of Lords press release, has been provided separately for each programme as Annex I (AIM) and Annex II (Radiation Protection).

ANNEX I

Advanced Informatics in Medicine Programme—Aim

INTRODUCTION

1. In health care informatics, the Department has been involved in *AIM*, an EC Research and Development programme with the objective of securing the improvement of health care throughout Europe through the use of Information Technology and Telecommunications.

2. The Exploratory Phase of AIM was approved by the Council of Ministers in October 1988 as part of the FRAMEWORK II programme, with a budget of 20 million ecu to be spent in 1989 and 1990. Forty-three projects were awarded contracts, to be completed between June and December 1990. The UK's contribution of 18.8 per cent of the cost of the programme was met jointly by the Departments of Health and Trade and Industry (DTI) on a 75/25 basis. A proposal is currently before Ministers as for a main phase programme, part of FRAMEWORK III, approved as a whole in December 1989. Approval is expected by late 1990 with the award of contracts during 1991. Funding arrangements will be similar to those in the Exploratory Phase.

3. AIM is a shared-cost programme, with projects involving at least two Member States and including a commercial partner. They had to address at least one of a set of objectives for the programme drawn up by the EC in consultation with experts from all the Member States. AIM aroused much interest: a total of 212 project proposals were received. Thirty-four of the 43 projects involved UK organisations, over 50 in all—commercial companies, academic institutions, and health care bodies, and 12 projects had UK prime contractors. UK involvement in AIM is larger than any other member state.

4. SPECIFIC POINTS (issues as in House of Lords press release)

(i) The advantages and disadvantages in joining ISPS, to the UK, to the funding department, and to the participating institutions.

(a) The advantages to the UK of taking part are the potential health care improvement which should flow from a pan-European programme, including the development of international links for the exchange of information and data on treatment. For the participants, it has provided a unique opportunity to be involved in international projects, with the benefit arising from having access to a larger research base. In addition, there is the status of EC approval for a project, with the opportunities this gives for promotion of a successful result. Most have found it a valuable experience, and intend taking part in the next phase, or seeking a collaborative venture through another programme.

For the Department, apart from the potential benefit to the Health Service, there is the encouragement which the programme has given to health informatics research in the UK and the higher profile that this has received.

(b) The main disadvantage to the Department is the need to find funding for its share of the programme from a limited budget. For the participants, there is the need to comply with the rigid EC timetable, which some have clearly found irksome, plus problems arising in some cases where participants were unused to working on a collaborative venture. However, there is a clear benefit to the UK in taking part—the disadvantages are fairly minor.

- (ii) The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution.

No comment.

- (iii) The machinery whereby international programmes are set up and its adequacy in the UK.

No comment.

- (iv) The technical and financial criteria under which proposals for ISPs are presented and considered.

The technical content of the AIM programme is drawn up from the conclusions of the AIM Requirements Board, a group of experts from all member states. For AIM, this reflects developments in health care informatics combined with realistic expectations for the future. The budget proposal is the share of the overall R&D budget which (in a highly competitive environment) this is considered to warrant. It is then subject to the counter-proposals—see below (v).

- (v) The forums in which the decision to participate in ISPs is normally reached.

The final decision on the size and scope of a programme is taken by the Council of Ministers. It is then for UK organisations to respond to the Call for Proposals.

During the course of 1990 DH and DTI have been involved, with other Departments, in discussions, both formal and informal, on the future of the telematics part of the new Framework Programme. The overall programme was approved in December 1989, but it was some time before the Commission produced specific programme proposals for the constituent elements. Before this, there was a good deal of lobbying by interested parties which, though it had some effect, is seldom the most satisfactory way of reaching decisions.

Official involvement takes place at several levels. In the negotiations for the health care part of the telematics budget for the future phase, briefing has been provided for Cabinet Office representatives on the CREST Committee, and DH was part of the UK representation on an *ad hoc* Working Group set up by CREST to consider the EC proposals for telematic in detail. The consultation arrangements are satisfactory with DTI providing effective co-ordination. Striking the balance between interests such as maximising the budget for health care informatics, in the interests of UK R&D development, and the problem of funding such a budget from available resources, is never an easy task. Whilst the final decision is of course a consensus, the briefing to the Minister representing UK has to reflect this.

For the Exploratory Phase of the AIM programme, DH provided one of the two members of the AIM Management Committee (the other is from DTI). The Committee has worked well in conjunction with the EC management team in controlling the programme. There are, however, some concerns over the management of the next phase. A Telematics Management Committee is proposed which, whilst it will have considerable control over the telematics budget as a whole, may not be able to address the relatively small, individual projects in the detail possible up to now. Full proposals for this are awaited.

- (vi) Treasury/Cabinet Office guidelines—how they apply and how widely they are known and accepted.

DH is kept up-to-date with these and follows them.

- (vii) Treasury rules of “additionality”—how they apply in respect of ISPs and the Science Budget and how they account for inflow of foreign money.

No problems over “additionality” have arisen so far as the Department is not directly involved with any projects. We are aware of the need to ensure that this continues with the main phase.

- (viii) Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing, travel and family charges, commercial secrecy and intellectual property rights.

Some academic institutions have had problems in complying with the EC rules for funding researchers, as their accounting methods have difficulty in distinguishing teaching from research time, only the latter counting for sponsorship purposes. Problems over intellectual property rights (IPR) have not yet arisen as AIM so far has been “pre-competitive and pre-normative”, but we shall advise bodies entering future contracts to address the IPR issue.

- (ix) Impediments in other countries to their engaging ISPs (EEC; Commonwealth; USA; Eastern bloc), e.g., concern with national benefit and protectionism, COCOM restrictions, problems posed by national budgetary procedures.

We have not been aware of any.

ANNEX II

RADIATION PROTECTION RESEARCH (RPR)

1. *Background*

The Department have not handled any bilateral or multilateral proposals on RPR except those concerning the European Community (including those EFTA countries who regularly buy into EC RPR programmes). All the following comments concern how the UK respond to proposals for research made to the EC. However a number of UK scientists, both as individuals and as groups, participate in co-operative ventures, but these are not centrally organised. These would include participation in work with the World Health Organisation, the International Atomic Energy Authority, and the International Commission on Radiation Protection.

2a. *Scientific advantages*

To UK as whole: and also to DH: The EC management committee provides a forum for exchange of scientific information and encourages the submission of international collaborative projects. This can be an advantage for the dissemination and cross-fertilisation of scientific knowledge, a gain of the expertise of other member states.

To institutions: A wider basis of funding.

2b. *Scientific disadvantages*

To UK as whole: The occasional need to collaborate with institutions of an inferior calibre and the additional effort required to provide information to the EC.

To DH: None.

To institutions: Not known.

3a. *Financial advantages*

- (i) To UK as whole: None (but see disadvantages).
- (ii) To DH: None (but see below).
- (iii) To institutions: None though it is possible that increased publicity for programme participants may result in them individually gaining further commissions (but see below).

3b. *Financial disadvantages*

- (i) To UK as whole: There is an unofficial agreement in the EC RPR management committee that the amount allocated to each Member State will be equal to the proportion paid in by that State. No Member can thus either gain or lose financially by participating. This is to the disadvantage of the UK who previously gained over States with a relatively undeveloped RPR infrastructure, although the UK still gains with its percentage remaining marginally higher.
- (ii) To institutions: There is sometimes a delay before EC contracts and payments are processed.

4. *Hosting large facilities*

The National Radiological Protection Board (NRPB) is internationally recognised as an EC centre of excellence, but this is not a direct result of participating in EC work.

5. *Administrative mechanisms*

The UK Government is represented always on the management committee for the EC RPR programme. That member receives briefing from a group consisting of UK scientific experts and across-government scientists and administrators. Before each management committee meeting the group consider both research proposals which they rate on a four-point scale and also any policy and financial implications. The group is informal and co-opts experts where necessary on an *ad hoc* basis. The same group is also consulted when the programme as a whole is reviewed and when the Framework Programme is revised or renewed. The system works well, problems only occurring if papers are very late arriving from the Commission.

6. *Treasury rules on additionality*

Not applied to date.

We are not aware of any inflow of foreign money due to participation in ISPs.

7. *Impediments*

In UK: Nil return.

Elsewhere: Nil return.

Evidence from the Department of Transport

INTRODUCTION

1. This Memorandum sets out the views of the Department of Transport on the issues raised by the Sub Committee.

THE DEPARTMENT'S INTERNATIONAL SCIENTIFIC COLLABORATION

2. The principal international research programmes in which the Department participates form part of the European Community's second and third Framework R&D Programmes. Brief details of the three programmes—DRIVE, DRIVE II, and EURET—are set out at Annex 1. All the programmes have been developed within the arrangements for handling UK business with the European Community in which the Cabinet Office Science and Technology Secretariat co-ordinate policy and the Minister for Industry and Enterprise (DTI) represents the UK at the Research Council.

3. Responsibility for funding and programme management of DRIVE and DRIVE II (which forms part of the *Telematics* line of the third Framework Programme) is shared between DTp and DTI. The Department represents the UK on the EC's programme management committees supported by DTI, and both Departments share responsibility for national publicity to encourage UK participation. The Department's Transport and Road Research Laboratory (TRRL) is a contractor in a number of shared cost projects within the DRIVE programme.

4. The Department has no recent experience of funding international facilities. Apart from the EC R&D programmes, the Department's international scientific programmes are confined to a small number of bilateral and multilateral agreements including "concerted action" under the COST mechanism.

5. *Issues raised by the Sub Committee*

- (i) The advantages and disadvantages in joining ISPs to the UK, to the funding department, and to the participating organisations.

The principal advantages of EC research are to share the costs of programmes which individual national administrations alone could not afford. This enables UK organisations to participate in projects which will, in the case of DRIVE (and DRIVE II), provide the basis for common standards and specifications for driver information technology and telecommunications across the Community. Resources are required both at the planning stage to ensure that UK concerns are taken fully into account, and also in participating in managing the research. For TRRL, participation provides a market place to demonstrate its capabilities for research and its ability to promote technology transfer to industry.

- (ii) The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution.

The Department has no direct experience from which to comment.

- (iii) The machinery whereby international programmes are set up and its adequacy in the UK.

EC programmes such as DRIVE, which have developed through active participation of national policy makers and experts, provide a good basis for effective collaboration.

- (iv) The technical and financial criteria under which proposals for ISPs are presented; and
- (v) The forums in which the decision to participate in ISPs is normally reached.

Negotiations on the EC R&D Framework Programme are the responsibility of the Minister for Industry and Enterprise (DTI) supported by the Cabinet Office's Science and Technology Secretariat. The Department takes policy responsibility for particular parts of the programme within this co-ordinating framework aiming to ensure that wherever possible EC programmes are complementary to national programmes and that the principle of subsidiarity is applied. The Department considers the expenditure implications of Community programmes alongside domestic R&D expenditure to ensure that a consistent approach is applied to all public expenditure.

- (vi) Cabinet Office guidelines—how they apply and how widely they are known and accepted.

The Department has no direct experience of the type of major scientific programmes for which the guidelines were drawn up. Although they do not apply to the European Community Programmes, some of these principles need to be considered in formulating the Framework Programmes.

- (vii) Treasury rule of "additionality"—how they apply in respect of ISPs and the Science Budget and how they account for inflow of foreign money.

The approach to funding EC programmes requires the Department to:

- (a) Adopt the same rigorous approach to value for money with both Community and domestic R&D expenditure; and
- (b) Ensure that R&D resources are allocated in line with Departmental priorities.

This approach is necessary because Community R&D spending is treated in the same way as other public expenditure. The Department of Transport, like other Departments, consider what spending is needed on Community or domestic programmes as part of the annual public expenditure round.

- (viii) Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK scales, housing, travel and family charges, commercial secrecy and intellectual property rights.

The Department sees no particular impediments of the type raised by the Committee in the context of decisions on collaborations of the sort with which the Department is familiar. The major requirement is to ensure that there is adequate assessment of the value of Community research programmes underpinning any new Community proposals.

- (ix) Impediments in other countries to their engaging in ISPs (EEC; Commonwealth; USA; Eastern bloc) e.g., concern with national benefit and protectionism, COCOM restrictions, problems posed by national budgetary procedures.

The Department has not encountered particular impediments of this type in the context of EC R&D programmes. Member states decide collectively the terms on which non-members may participate in the EC R&D Framework Programme.

ANNEX 1

DRIVE

The DRIVE programme (*Dedicated Road Infrastructure for Vehicle safety in Europe*) is part of the second EC R&D Framework Programme 1987-91. The programme is administered by DGXIII. (Telecommunications, Information Industries and Innovation). DRIVE has a Community budget of 60 mecu (£44m) over three years (1989-91).

The objective of the programme is to contribute to development of a framework in which advanced IT and communications can be harnessed to improve the efficiency and safety of passenger and goods transport and reduce their impact on the environment.

DRIVE II

A successor programme to DRIVE (DRIVE II) has been proposed as part of the Telematics element of the third EC R&D Framework Programme 1990-94. The detailed breakdown of the budget has not yet been settled but it is expected that 120 mecu (89m) will be allocated to DRIVE II over the period 1991-94.

This will build on research carried out under DRIVE and will concentrate on the needs of users, those concerned with safety, provision and maintenance of infrastructure, and the provision of transport services. The activities proposed are the definition of functional specifications in the context of a strategy for the use of technology and telematic systems for communication and traffic control, the development of new technologies and experimental systems, and validation work.

EURET

EURET (*European Research on Transport*) is an "overhang" from the second EC R&D Framework Programme 1987-91 administered by DGVII (Transport). The EC budget for EURET is 25 mecu (£18m) over three years. The programme is likely to receive final approval from the Research Council by late 1990.

The programme aims to enhance the effectiveness, economy and safety of transport systems. It consists of 11 topics grouped under three heads:

- (i) Optimum network exploration.
- (ii) Logistics.
- (iii) Reduction of harmful externalities.

The scope of the programme is wide-ranging: it covers transport by air, sea, rail and road.

Evidence from the Economic and Social Research Council (ESRC)

EXECUTIVE SUMMARY

ISPs are under-developed in the social sciences. ESRC's total contribution to ISPs is only £235K in 1990-91. However, there are good reasons to believe an expansion of ISPs in social science would be very timely—some reasons common to both the natural and social sciences, others more particular to the social sciences. Given that ESRC does not have the resources to extend significantly its own commitment, the only means Council has to make its contribution to developing ISPs are to re-orientate existing ISP commitments towards top priority ESRC programmes and influence other bodies indirectly. New top-down ISPs are to be avoided. ESRC participation in ISPs is decided at Council level. The general European Commission view on “subsidiarity” as applied to ISPs and social science is incorrect. The scientific standing of Eastern European social science hinders the prospects for ISPs with those countries.

EVIDENCE

1. International Scientific Programmes (ISPs) in the social sciences are significantly under-developed, both in comparison with natural sciences and relative to need.

2. A complete list of ESRC direct expenditure on participation in ISPs illustrates the modest scale of current commitments:

Anglo-French Research Programme (1990-91 spend £50K)
 ESF subscription, Programme & Networks (£75K)
 “Vienna Centre” subscription (£50K)
 Anglo-French Exchange Scheme (£20K)
 Anglo-German Exchange Scheme (£15K)
 British Academy/ESRC China Exchange Scheme (£25K)

3. Social scientists, like natural scientists, always have much to gain from the intellectual stimulation provided by contact with scientists in other countries. In a number of areas of social science there is considerable potential for improving the quality of UK science through such contact. There are four reasons why the enhancement of opportunities for such stimulation is particularly timely at present:

- (i) The increasing integration of national economies and societies, e.g., the Single European Market, socio-economic aspects of Global Environmental Change.
- (ii) New opportunities to develop the *comparative* method, e.g., with the opportunity to co-ordinate work on demographic change using cross European census data.
- (iii) New opportunities to promote *collaborative* research between national centres of excellence in research, e.g., through the human capital provisions of the third Framework Programme.
- (iv) The pressing need to underpin these collaborative and comparative opportunities with agreed international standards on data handling—from geographic information systems through to archiving.

4. The case under (iii) and (iv) is probably common to the natural and social sciences. Of those more particular to the social sciences (i) is now becoming generally accepted while (ii) requires a little more elaboration. With a few exceptions, social scientists do not have the opportunity to conduct laboratory experiments. The study of how different societies react to and influence what appear to be common problems goes some way to providing a substitute for the laboratory. One current example would be the way in which most “northern” EC countries are facing an ageing population structure. Such comparative research questions are given an added impetus just now. Our ability to manipulate what are primarily nationally collected data sets has increased enormously in recent years. There is now the possibility of drawing together these national data sets to perform qualitatively more extensive comparative studies than ever before.

5. However, despite the case for more ISPs in the social sciences, for ESRC there is a difficulty in that it is a very small Council with no institutes of its own. There are obvious problems in providing a means to increase participation in ISPs, despite the obvious need. Council is therefore pursuing:

- (a) Means of influencing new opportunities for the UK social science community to participate in ISPs where the ESRC is itself unlikely to act directly in the Programme once established (e.g., the Environment and Human Capital lines in the new EC Framework Programme).
- (b) Encouraging participants within Council Directive programmes to develop—at the scientist to scientist level—collaborative projects under those programmes.
- (c) A review of Exchange Schemes and existing commitments to establish the scope for alternative sources of funding and/or a closer orientation to Council objectives.

6. Council is *avoiding* new ISPs which rely on a “top-down” setting of research agendas, preferring instead to ensure an exchange of information on nationally organised programmes. For example, ESRC along with other “Western” social science research Councils, has resisted attempts to establish a social science equivalent to the International Geosphere Biosphere programme. Similarly, Council has (with CNRS in France) changed the basis of its only existing bilateral Research Programme to concentrate on

building collaborative projects within priority programmes of the two countries. It is hoped that this is a model (a bare minimum of enabling administration, scientist led within priority programmes) which can be extended to other countries when resources allow.

7. Given differences between the current level of ISPs in social and other sciences a number of the Committee's specific points are only marginally relevant to ESRC (especially (i) (iii) (vi) (viii)). However, ESRC would like to draw attention to three particular points.

8. (Your reference v) The decision taken on participation in ISPs is taken at Council meetings. ESRC systems are designed to bring all new proposals for funding (including ISPs) to one Council meeting each year to enable the best marginal value to be realised from Council resources.

9. (Reference vii) Given the lack of EC funding to date for social science, additionality and attribution have not *so far* had any impact on ESRC operations. Obviously, Council will need to monitor the effects of the Third Framework Programme where this could change.

There is a further point which is unique to the social sciences. There appears to be a widespread belief in the Commission that "subsidiarity" means that virtually all social science research can be left to Member States. However, there are some issues where Community resources (properly managed) would be appropriate and add value to national programmes whether because of the nature of the problem or the resources needed to tackle the research. Happily, the Commission's draft proposals on Socio Economic Environmental Research appear to provide this kind of input. This is a very welcome exception to the previous Commission neglect of social science research.

10. (Reference ix) There are particular problems in developing social science ISPs with the former "Eastern bloc". Many of those holding social scientific positions under the former regimes did so for ideological rather than scientific reasons. Whole areas of research were neglected and the general standard of new holders of scientific positions is considerably lower than in the "West". ESRC is making what response it can to assist—part funding two summer schools for Soviet Sociologists and exploring exchange contacts with Hungary where there is most prospect of benefit from exchange. However, such is the scale of the problem that significant resources need to be invested over a number of years before the standards will approach UK levels of expertise. Resources from Europe (TEMPUS, ACE) and national sources (such as the "Know How" fund and any new fellowship schemes) should reflect the need to address the shortcomings of "Eastern bloc" social science.

Letter to the Clerk from the Director-General of the European Molecular Biology Laboratory

Dear Mr Walters,

Thank you for your letter of 18 June 1990 and the invitation to submit written evidence to Sub-Committee II—International Scientific Programmes of the Select Committee on Science and Technology.

I have experience of two international scientific organisations of which the UK is a member state, namely the European Molecular Biology Conference (EMBC) and the European Molecular Biology Laboratory (EMBL). The secretariat of the EMBC and the EMBO is housed in the EMBL Heidelberg. I assume that members of the Sub-Committee have access to the basic documents—the Agreements establishing EMBC and EMBL—since they have been ratified by Her Majesty's Government. I am enclosing a copy of a pamphlet published last year to commemorate the 25th Anniversary of the European Molecular Biology Organisation and a copy of the more recent Annual Report of EMBL. Should you require additional copies of these publications please let me know and we will dispatch them. (*Not printed*)

The Pamphlet for EMBO's 25th Anniversary begins with a fairly detailed history of the European Molecular Biology Organisation, the European Molecular Biology Conference and the European Molecular Biology Laboratory. If members of the Sub-Committee wish to learn about the evolution of these three bodies and their inter-relationships I recommend that they read the beginning of the 25th Anniversary pamphlet.

Concerning the nine scientific issues listed in your letter I have the following comments to some of them.

- (i) The UK has an excellent tradition and record in basic scientific research and in particular in molecular biology. The MRC Laboratory of Molecular Biology is one of the most outstanding centres for molecular biology research in the world. The UK has participated in the EMBC and the EMBL since their foundation, to the mutual benefit of the UK and the two organisations. The statistics concerning EMBO fellowships given in the 25th Anniversary pamphlet show that the UK has participated to a greater extent than any other member state in this exchange programme. At the EMBL 25 per cent of the staff are from the UK, the second largest national group, Germany with 36 per cent being the largest. At least in the field of molecular biology the UK can only benefit from an expansion of European international programmes.
- (ii) To judge from the benefits gained by Germany by hosting the EMBL my advice to any country in Europe would be to try to attract international laboratories to its territory. The EMBL,

provides a significant contribution to the local Heidelberg economy, and to the local scientific community which includes Heidelberg University, several Max Planck Institutes and the German National Cancer Research Center. The investment and financial incentives offered by the German Federal Government, the Government of the State of Baden-Württemberg and by the city of Heidelberg in the early 1970's to attract EMBL to Heidelberg have paid handsome dividends.

- (vii) The UK contributions to the annual budgets of EMBC and EMBL are paid by the British Medical Research Council. The MRC state that they are not fully reimbursed for these contributions by the Treasury so that contributions to EMBC and EMBL eat into the funds available for national laboratories. To what extent this is really the case is hard for me to ascertain since I do not know the details of the budget negotiations between the MRC and the Treasury. However, it is clear to me that member states' contributions to international scientific organisations ought in principle and in practice to be additional to the funds available for national laboratories and not in direct competition with the latter. Several member states of EMBC and EMBL pay their contributions from the budget of the Foreign Office or the Ministry of Science, and not the national research councils. In my experience this is a much healthier situation for all concerned.

I wish to take this opportunity to draw the attention of the Sub-Committee to two other issues not specifically mentioned in your letter. The first is the adverse consequences of the British Nationality Act 1981 for the UK staff at EMBL. Briefly, if British EMBL staff have children while working at EMBL (a frequent occurrence since most of our staff are in the 30-40 year age group) then those children have full British citizenship and residence rights. But should those children have children while working overseas the latter, i.e., the grandchildren of the EMBL staff, will not necessarily have the right to full British citizenship and the right to reside in the UK. We have corresponded with the Home Office on this issue but they are not prepared to exclude EMBL staff and no doubt CERN staff from the consequences of the Act. I understand that members of the armed forces, Foreign Office staff, employees of the Commission of the EC and MRC staff seconded overseas are excluded from the adverse consequences of the British Nationality Act. Why then are scientists working at EMBL, CERN and other such organisations treated differently to soldiers, diplomats and EC civil servants? This is a question of importance to British staff members of EMBL and one I would be grateful to have raised with the Sub-Committee.

Finally I wish to draw your Committee's attention to a proposal for a significant expansion in European programmes for basic molecular biological research. The relevant document is enclosed with this letter. It seems to me clear that, if Europe is to compete with the United States in basic research, there has to be an expansion of European as opposed to purely national investment in basic research. The individual countries of Europe, even the larger ones, Germany, France, Italy and the UK, are not able on a purely national basis to compete with the USA. In the longer term more research funds should be competed for on a Europe-wide basis than on a national basis. Only in that way will Europe become a more united and integrated scientific as well as political and economic unit.

The proposal that is enclosed here envisages establishing a programme of research units and research grants that would be competed for internationally. We have in mind a programme for Europe in many ways comparable to the Howard Hughes Medical Institute in the USA, but on a smaller scale at least initially. Such a programme, to be successful, must be managed by a peer review process, on an international basis. It should not be managed by the Commission of the EC, although the funds could come via the EC with EMBO acting as a contractor responsible for management. The EC is not the ideal body to manage basic science because it is too bureaucratic and political considerations play too great a role in its decisions, in my opinion. We need in Europe agencies comparable to the US National Institutes of Health, and the US National Science Foundation in which peer review is the management tool and the funds are open to competition from anywhere in the 50 states of the USA.

I am not advocating that all support for basic research should be open to international competition, but I am advocating that in addition to current national funding through national agencies we need to superimpose international funding with international competition for the money available. The international programme can then evolve and in the very long term perhaps become more important than the national granting agencies. Europe must in basic science pool its financial and intellectual resources to remain competitive.

I hope that these comments will be of use to your Sub-Committee.

Yours sincerely,
Lennart Philipson

Evidence from the European Science Foundation

The ESF is 16 years old. It is not a "foundation" in the normal sense; it is an association of all the research councils and leading national academies of Western Europe (stretching down the Adriatic through Yugoslavia, Greece and Turkey), and is likely soon to acquire some Member Organisations in Eastern

Europe as well. Most of its money comes from its Members. It is non-governmental; its employees (about 20, working out of an office in Strasbourg) are not international civil servants, and pay income taxes, etc., like everyone else; most of the scientific staff are seconded from Member Organisations.

ESF's business is to put together science projects, and (more importantly) scientists from different countries. It does this not chiefly in pursuit of an internationalist crusade (and certainly not out of any antipathy towards intercontinental scientific cooperation with the USA or Japan), but for scientific reasons: science cannot work successfully or cost effectively within individual parishes, counties or nation states—it needs and deserves a far wider and freer field of play. International journals and conferences and electronic interchanges of course provide much of what is required—scholars do not need to wander across Europe with begging bowls or knapsacks to find out what is happening in other Universities, as was necessary (and practised quite successfully) in the first 900 years of our millenium. But, bluntly, most middle-grade natural scientists in their early 40s (and an even larger proportion of historians) work in their home countries, in their own labs or libraries, in their own languages, on their own promotion ladders.

ESF exists to help make it possible, when the scientific opportunities are propitious, to widen substantially these horizons. It is obvious, for instance, that for the study of geology the UK and *a fortiori* Switzerland are wonderful laboratories; but not nearly wonderful enough if the aim is to learn fully the structure and dynamics of the lithosphere in our segment of the globe. Hence the widely acclaimed success of the ESF European Geo-Traversal, now reaching the end of its nine-year project life, which explored our geology from the North Cape of Norway along a line which cut the Alps and terminated in North Africa. The questions were pan-European; the techniques (with multiple and widely spaced reception stations for seismic recording, etc.) made use of long base lines; the study centres (which examined and interpreted the evidence in the closing years of the project) brought together many disciplines, nationalities, ages. (The language used, of course, is “broken American”, normally called, out of courtesy to UK scientists, “broken English”.)

Amongst the ESF's 40 current Programmes and Networks there are several different paradigms for what makes a project suitable for execution on European scale. In the geological case, it is the questions, methods, people who have to be “continental” in scale. In several ESF projects in the life sciences, the essential feature is a wide- but thinly-spread set of excellent but specialised scientists, whose abilities (and physical resources) can be pooled; for instance in the neuro-sciences (the Brain and Behaviour Research Programme, the Network on Neural Mechanisms of Learning and Memory, the Programme on Molecular Neurobiology of Mental Illness). In the European Glaciological Programme, and various enterprises in oceanography, European scientists are acknowledged world leaders, and ESF action is reinforcing success.

For ESF, as in most advanced countries other than the USA and the UK, “science” is an omnibus term: it covers the systematic study of every topic, from Byzantine law to astrophysics, from molecular recognition to developmental psychology. An ESF project on minority Ethnic Groups in the century up to the Second World War brought together 100 historians from almost all countries of Europe in a six-year study that will produce eight books: no-one, alas, could deny the “European-ness” of this work. One of ESF's main projects in environmental sciences concentrates on environmental change and the economic and institutional ways in which that change can be handled.

An Annex describes the two main modes of ESF work—Programmes and Networks. ESF tries to maintain the flexibility and capacity for innovation that should be characteristic of a body that is striving to change things, to reduce barriers, to enlarge the European “scientific market” of ideas, job opportunities, co-operation and competition. So it is developing currently a number of new methods of working: Research Conferences (following the US pattern of Gordon Conferences); Fellowship schemes to be “linked” to its own projects; several groups which are advisory to Government (on ground based astronomy, the human genome, etc.); and its traditional role of laying the intellectual foundations of European scale facilities (e.g., for synchrotron radiation) is being continued in the case of oceanography.

In oceanographic and in other fields, ESF is developing “partnership” enterprises with the European Commission (DG XII). ESF's own Member Organisations taken together remain much larger, certainly in the field of basic science, than is DG XII; but DG XII is very much larger (spends much more money), even in the narrow field of basic science, than ESF. Nevertheless, ESF is thrusting forward vigorously in its partnership ventures, and it appears to ESF that the European Commission's staff are genuinely keen to make these arrangements work.

ESF's field of action is “basic science”. That is still a proud remit, now as it was in 1975. But whereas many of ESF's Member Organisations have widened their own fields of action since then, into some areas which seem to have something to do also with the application of science, ESF remains firmly “up-stream” in the statutory definition of its interests. Although at times this seems a handicap, fashions do fluctuate; ESF is, in any case, content with the large area of science open to it; and its officers have a strong disinclination to engage in controversy about the meaning of words.

ESF is small. Its total cash flow is no more than £5 million a year; even when its current growth programme (over the next four years) is completed, it will not be handling more than two or three times this sum. No doubt whoever is its Secretary General in five years time will be arguing for another substantial

step forward. But it is important to note that it spends “high-powered pennies”; each penny it spends enables/encourages/entails much more spending by its own Member Organisations; it is calculated, for instance, that in the case of the Geotraverse, ESF as such did not spend more than about £2 million over the whole life of the project—but ESF’s Member Organisations, taken together, probably spent £30 or £40 million.

Finally, a point addressed specifically to the Sub-Committee’s terms of reference and to the specific questions listed in Mr Walter’s letter. International Scientific Programmes (ISPs) are usually thought of as large, long term, capital intensive science—accelerators, telescopes, ships, large internationally run laboratories. ESF does operate a little in these fields, for the most part at the preparatory stages. Smaller scale, informal, “people-intensive” co-operation is however the main centre of ESF interest: here ESF’s added value is in part the scientific progress which is thereby encouraged, but in large part also the communities of scientists which are thereby built.

UK interest in ESF’s work has always been positive and friendly; more recently, as ESF’s influence has begun to grow more markedly, the UK has been at the forefront both in using the ESF machinery and in contributing to the improvement of that machinery. ESF’s Founding President was Lord Flowers; Sir William Mitchell is a current Vice-President; Sir Arnold Burgen has carried the main responsibility for the successful development of ESF’s Networks; there are a large number of UK Chairmen of ESF projects and committees of all sorts.

Because the direct cost of sharing in ESF work is relatively so small—well under £1 million per year for the seven British Member Organisations taken together—there is very little of the sort of “angst” which appears when real ISPs are considered. However, it is increasingly and correctly recognised by the UK Research Councils that, as in the case of the Geotraverse, participation in the direct ESF co-ordination costs of co-operative programmes can be the tip of an iceberg, because UK scientists who participate in first class and exciting European projects are often well placed to submit first class applications for research grants to the UK research councils.

Increasingly, however, the UK research councils, and their wise equivalents overseas, are sailing close up to these “icebergs”, with their eyes wide open, in full understanding of what they are doing: hitching a ride on a moving platform, with congenial and highly professional colleagues from neighbouring countries. To change the metaphor—when ESF presents a well prepared Programme to its Member Organisations for *à la carte* financing, it seldom has difficulty in filling the financial subscription list.

The Committee may wish to know that I gave evidence on 25 April 1990 to the House of Commons Education, Science and Arts Committee concerning its enquiry on “Science Policy and the European Dimension” and many of the points in that evidence may now be of interest to Lord Carver’s Sub-Committee.

Strasbourg, July 1990

ANNEX

ESF SCIENTIFIC NETWORKS

Networks are primarily orientated towards co-ordinating activities in order to stimulate and consolidate the scientific community in specific fields. A main idea of a Network is to foster mutual awareness and to promote mobility, which are matters that pertain to individual scientists and to their organisations in building scientific communities on a European scale. This includes the organisation of workshops in specific fields as well as other kinds of international meetings. In addition to these types of activities, small collaborative research projects may be undertaken in order to strengthen the construction of scientific communities. In certain instances, Networks may also lead to the establishment and implementation of larger collaborative research enterprises.

Underlying the Network concept are the following characteristics:

- A Network should be so designed as to bring together people working in the same field in Europe so as to strengthen that area of science or to consolidate an area of science that was already strong.
- A Network should increase the mobility of scientists in Europe.
- A Network should be self-managed. Its initiation, organisation and scientific supervision should be matters for the scientists themselves (“bottom-up” approach). The scientific community should seek appropriate support structures and financial means from national or international sources.
- A Network may adopt a wide variety of forms of communications and co-operation (liaison, contact, information, exchange, joint exchange, joint research and high-level training projects) and as such be a very flexible entity.
- A Network should be open to an interdisciplinary approach.

The flexibility of the Network concept can be illustrated by three examples. The *Network of Earth Science Study Centres* has held a series of five concentrated, two-to-three-week long workshops in which data

obtained from field studies of the European Geotraverse project have been intensively worked up by scientists and graduate students. They have provided fine transnational training groups as well as making possible excellent research reports.

In contrast, phase 1 of the *Network on Polar Science* acted as a planning organisation for major research initiatives, one of which, the *European Polarstern Study (EPOS)*, a study of the ecology of the Southern Ocean, has been implemented as Phase 2 of the Network. The other research initiatives undertaken in phase 1 gave rise to ESF Scientific Programmes in Arctic Geosciences and in Polar Glaciology.

Finally, the aim of the *Network on Neural Mechanisms of Learning and Memory* has been to bring together those key individuals and laboratories in Europe working on the experimental analysis of the neural mechanisms of memory processes, viewed within the context of neural plasticity. A Register has been compiled, covering some 90 laboratories and research groups working in this field, and making it possible for laboratories working in particular areas to identify those with parallel or complementary interests. Two workshops have been held to work out some common definitional and methodological approaches to the field, and an open conference brought together nearly 250 registrants for a full programme of plenary lectures and poster sessions.

The ESF Executive Council, following the recommendation of the Network Committee, may launch a Network for a two- or three-year period with a budget for the activities planned during this period of around FF 650,000, financed from the ESF Network Account, without specific *à la carte* decisions by Member Organisations.

ESF Scientific Programmes

Programmes in all fields of science are managed by ESF. While ESF Network Proposals typically come directly from working scientists, Programmes are for the most part sponsored by our Standing Committees.

Programme preparation can be swift (less than a year—nearly as fast as Network preparation) but typically as much as two or three years *can* be spent in bringing to the starting post a complex programme involving scientists from a dozen countries, and funding from as many different ESF Member Organisations.

Clearly not *all* scientific investigation in Europe needs or deserves such careful preparation. ESF projects (there are currently 20 in full operation or late stages of preparation) are selected where large value is added by the *transnational* or continental scale of work. Three examples:

- The *European Geo Traverse*, involving investigation of the Earth's crust along a line from North Norway to North Africa. Each experiment ("hole in the ground" + manpower + instrumentation) is paid for by the national Research Funder in individual countries; but the programme is planned, co-ordinated, and interpreted by a team of scientists working under the ESF flag, and aided by the Strasbourg Office of ESF. ESF has spent no more than three MECU during the whole nine years of this Programme; Europe as a whole has spent *twenty* times as much; the output could never have been achieved by national groups working on their own.
- *Molecular Neurobiology of Mental Illness*. This programme started in 1990, after two years as an ESF Network. The aim is to co-ordinate the mapping of the human genome for linkage to schizophrenia and affective disorder, to identify the genes which confer susceptibility to these illnesses. There is a strong transatlantic connection in this work, which brings together molecular biologists and psychiatrists.
- Non dominant (minority) *Ethnic Groups in Europe*, to 1940. This study, completed in 1989, will give rise to eight volumes, each thematically arranged with examples from right across Europe. Nearly 100 historians worked together on this project, which combines detailed specialist knowledge with a broader perspective.

Scientific programmes are funded *à la carte*, by ESF Member Organisations. They typically last between five and eight years.

Evidence from the European Space Agency

The Agency's programmes with a significant science content fall into two distinct categories, the Science programme itself, a mandatory programme, to which all member states of the Agency contribute on a Gross National Product (GNP) scale, and the Earth Observation programme, an optional programme, to which member states contribute according to their interest in the programme.

Turning to the specific questions raised, the following evidence is submitted for consideration by the committee:

1. The participation of the United Kingdom in the European Space Agency's Scientific Programme.

The Agency's Scientific Programme, named Horizon 2000, was approved by the Agency's Council meeting at Ministerial level at Rome in 1985. Further endorsement was given by the Council meeting at Ministerial level at The Hague in 1987.

The Horizon 2000 programme provides a well structured framework for European Space Science extending into the first decade of the next century. Based upon four large "cornerstone" missions, each with specific scientific objectives, it also provides for additional medium and smaller missions which are selected on their scientific merit from the competing proposals of the European scientific community. For the time being no scientific missions are undertaken, other than those planned by Horizon 2000.

The main counterpart of the Agency in the area of space science is the Science and Engineering Research Council (SERC) which acts through the British National Space Centre (BNSC). The BNSC, seen from the Agency's viewpoint, can be characterised as follows:

- It is the main focus for civil space interests of UK Government Departments.
- Its main activity is the co-ordination and implementation of UK space programmes.
- Its responsibility is to advise Ministers on space policies and to interface between the UK and other countries and space agencies.

The main branches of BNSC interacting with the science programme of ESA are the Science and Microgravity division (Director: Ms V Bowell), and the Space Science Programme Board (Chairman: Professor L Culhane).

According to the current UK policy for space science the national activities are based primarily on ESA's Horizon 2000 programme, while to maintain balance and continuity, complementary involvement in selected bilateral missions is also undertaken.

The space science community can be broadly divided in two major areas of interest, i.e., Astronomy and Solar System research.

Astronomy

The main interests in the field of astronomy are:

- Nature and origins of the universe (Clustering, Large scale structures).
- Formation and evolution of galaxies (Active Galaxies, Quasars).
- Formation and evolution of stars (Neutron Stars, Black Holes).

The participation of the UK in space science missions in these fields are shown in the following table.

Mission	Launch	Country/Agency	Mission outline	UK cost ¹ (£m)
Hipparcos	1989	ESA	Astrometry	Data Analysis
HST	1990	ESA/NASA	UV/Visible IR Observatory	Data Analysis
ROSAT	1990	Germany/NASA	X-ray/EUV Survey	18.4
ISO	1993	ESA	IR Observatory	8.9
Spectrum-X	1993	USSR	X-ray Spectrophotometry	7.5
Radioastron ²	1995	USSR	VLBI Antenna	
Lyman/Fuse	1997	NASA	UV Spectroscopy	5.6
AXAF	1997	NASA	X-ray Observatory	0.5
XMM	1998	ESA	X-ray Spectroscopy	11.0
FIRST ²	?	ESA	FIR Spectroscopy	

¹Costs for ESA missions exclude subscription.

²Participation not yet approved.

Solar System Research

The main interests in the field of solar system research are:

- Interior of Sun
- Propagation of Energy in Solar in Atmosphere (Solar Activity, Solar Flares).
- Origin of Solar Wind; interaction with Solar System Bodies
- Magnetospheric and Ionospheric Studies
- Formation of Solar System; Evolution of planetary atmospheres

The participation of the UK in space science missions in these fields are shown in the following table.

Mission	Launch	Partners	Mission Outline	UK Cost (£m) ¹
Galileo	1990	NASA	Jupiter/Interplanetary Medium	0.1
CRRES	1990	NASA	Magnetosphere	0.1
Ulysses	1990	ESA	Solar Polar Studies	0.5
Solar-A	1991	Japan	Solar Flare Studies	1.6
Mars Observer	1991	NASA	Mars Orbiter	0.2
Polar	1993	NASA	Magnetosphere	0.3
Mars 94	1994	USSR	Mars Encounter	0.5
CRAF	1994	NASA	Comet Rendezvous/Asteroid Flyby	0.4
SOHO/Cluster	1995	ESA/NASA	Solar Terrestrial Physics	19.8
Turbulence ²	1997	USSR	Magnetosphere	
Orbiting Solar Laboratory ²	1997	NASA	Solar Physics	
Cassini ²	1997	ESA/NASA	Saturn Orbiter/Titan Probe	
Rosetta ²	?	ESA	Comet Sample Return	

¹Costs for ESA missions exclude subscription.

²Participation not yet approved.

The profile of UK space science activities is such that more than 95 per cent of the activities is centred on research conducted via satellites and deep space probes, while less than 5 per cent of the activities make use of rockets and balloons.

There is a broad though balanced distribution over the whole range of interests. The participation in nine projects in Solar System Research has already been approved, as well as in eight projects in Astrophysics research.

UK Technological Development

Space research offers opportunities for major technological developments. The most significant programmes currently under way in the United Kingdom are:

- Magnetometer development (ICSTM).
- On-board processing of Planetary Radar Altimeter Returns (MSSL, UCL, RAL, BAe).
- Photo emission X-Ray Polarimeters (Leicester).
- Micro-channel plate Readout Systems for Compact Optical Image Intensifiers (MSSL, UCL, ICSTM, RAL, ITL, SIL).
- Extreme Ultra-Violet filters (RAL).
- X-ray Micro-calorimeters (MSSL, QMW).

The participation by the United Kingdom in the Agency's Scientific Programme, the projects of which are of a scale which by and large could not be funded as national programmes, enables scientists and industry to contribute to undertakings which are at the forefront of science and technology. Scientists are encouraged to collaborate in the achievement of major scientific objectives and are provided with the opportunity to influence the development of the programme by proposing experiments or projects for inclusion.

The regular participation of scientists from the United Kingdom in the Agency's scientific advisory committees allow them to contribute directly to the process of defining the programmes' content.

The space science projects of the Agency have for many years supported the continuation and expansion of the scientific communities in the Agency's member states which would have otherwise been difficult to maintain. The Horizon 2000 programme will enable them to be kept intact and to be developed.

In addition to the United Kingdom's participation in the scientific programme of the Agency is the national funding made available to scientific institutes to develop space experiments and exploit the data they produce. In general such funding is made available only when an experiment has been selected to fly on an ESA satellite. This practice provides those responsible for assigning funds to scientific institutes with criteria for the selection of priorities and ensures that the approved funding is applied to a well defined objective.

Industrial participation in the design, development and manufacture of the Agency's scientific satellites is of major national importance. The contribution made by the industries of the United Kingdom to the success of the Agency's programme has been and will remain a major one.

2. Funding of the Agency's Science Programme in the United Kingdom.

The unique source of funding for the Science Budget in the UK is the Science and Engineering Research Council (SERC). The SERC finances only the Science Budget in ESA. All other ESA programmes and the General Budget are financed from the Department of Trade and Industry.

The SERC is the source of national funding in basic research in the UK and in addition to ESA's Science activities it funds international scientific organisations such as CERN, the Lauë-Langevin Institute, etc. The

fact that the SERC has to support financially this double responsibility has created difficulties in nearly all these international organisations whose budgets have to compete with the overall funding of basic research in the UK. The burden on national funding which ensues has led the administration of SERC to question their level of participation in international organisations. This resulted in the organisation of reviews of the management and procedures of these organisations, led by European scientists of renown such as Prof. Abraham for CERN and Prof. Pinkau for the ESA Science Programme.

The foundation of the ESA Science Programme Review Team was the result of the request of the UK delegation at the ESA Council in December 1988 following as lengthy discussion on the new level of resources (five-year budget) presented a year earlier in the Hague on the occasion of the Ministerial Council of ESA. At that meeting, the Director General requested the continuation of a 5 per cent annual increase of the Science Budget until 1992. The ministers had previously endorsed, in Rome in January 1985, an annual increase of 5 per cent for five years, which represented the first half of the budget increase necessary to support the Horizon 2000 Long Term Plan for Space Science. The new level resources presented in the Hague in November 1987 would have granted an extra increase of 5 per cent for three more years, it being understood that the increase necessary to cover the needs of the Horizon 2000 Programme (i.e., two extra years of 5 per cent increases) would have to be negotiated in December 1990.

In December 1988 the UK accepted to join all the other Member States in granting the 5 per cent increase until 1992. They refused, however, to add on top of the budget, the contributions of the three new Member States which had joined ESA in the meantime, namely Austria, Finland and Norway, whose contributions therefore reduced those of the existing Member States, depriving the Science Budget of some £5 million annually.

The UK conditioned their acceptance on an overall review of the Science Programme. The Review Team, composed of professional managers and Science Policy makers (Sir Robin Nicholson was a member of the Team) conducted its work in the course of 1989 and presented its report to the Council at the beginning of 1990.

The report contained a series of recommendations which aimed at maintaining the scientific quality, the integrity and the balance of the Horizon 2000 programme. The management of the programme itself was not criticised by the Review Team which recommended, however, that savings be made in the overall ESA system to an amount of 26 million pounds per year in order to alleviate the charges imposed on the Science Budget by an accumulation of events which could not be foreseen in 1985 when Horizon 2000 was formulated. These events were essentially the delays of the Hubble Space Telescope, the Ulysses mission, and Hipparcos, which resulted from the US Shuttle accident and the launch failure of Ariane, and induced a shortfall of nearly 70 million pounds in the Budget.

These 26 million pounds annual savings were considered as realistic by the Review Team if a relaxation of the internal Recharging Policy of the Agency, and of the rule of fair return (see also section 6) were considered. Other recommendations included in the Team's Report aimed at improving the control of costs and strengthening the management of projects.

These recommendations are presently under analysis by the Executive and by the various committees of ESA, and will be discussed at Council in October and December 1990. The Director General has already proposed a new internal re-charging policy which would indeed relax the Science Budget by an amount of about 13 million pounds annually. This would increase the "purchasing power" of the Science Budget, provided that these reductions (which would have to be paid by the other programmes and by the General Budget) remain in the Science Budget and are not deducted from it. However it has not been possible to find the additional funding in the other programmes needed to implement this recommendation, and in particular the relaxation of industrial return rules, which would most likely require ministerial approval if they were to be changed, is not considered to be a realistic source of savings.

The UK delegation at Council have further requested that some recommendations, management issues mainly, be analysed by a special external consultancy. This has been commissioned and a report is due in September 1990.

In summary, the UK delegation has, because of the particular organisation of research in the UK, transferred part of its difficulties to Europe. Certainly, reviews are to be considered useful when they aim at improving the organisations or the systems with which they are concerned. It is ESA's hope that this one will lead to some achievement. At a recent meeting between SERC and the Agency, in which Mr R Jackson participated, it was said that the proof that savings can be made is a prerequisite to the acceptance by the UK of any further financial support to the Agency's Science Programme. This is an important statement. If nothing were to come out of the work of the Science Review Team it is true to say that for the first time in the history of ESA, missions already programmed would have to be stopped and cancelled, placing the survival of the Agency's Long Term Science Plan in jeopardy.

The Agency hopes that European solidarity and wisdom will prevail in order to prevent such a situation occurring and appreciates the support of the politicians in this respect.

3. The participation of the United Kingdom in the Agency's Earth Observation Programme.

The objectives and strategy for earth observation in Europe identify four areas on which the Agency's programme focus:

1. Environmental Problems.
2. Resource Management and Monitoring.
3. Operational Meteorology.
4. Solid Earth (gravitational field mapping).

The various polar orbiting missions represent the most prominent component of the current earth observation programme.

In considering objectives for polar and low inclination missions, it is important to bear in mind a key requirement for many sections of the earth observation user community. This is the need for data continuity. Many of the objectives of the Agency's earth observation programme are very dependent on the realisation of this objective. An uninterrupted sequence of carefully selected observations is widely seen to be essential to increase the capacity of Participating States to manage and conserve the planet's resources and to monitor our environment and the climate.

The United Kingdom contribution to the Earth observation programme is co-ordinated by the British National Space Centre and by the United Kingdom Meteorological Office. The operational exploitation of meteorological data is managed by another international organisation, in which the United Kingdom participates, EUMETSAT.

Data from the operational METEOSAT satellites assists the UK Meteorological Office with its activities such as forecasting and climate research, this latter activity being recently expanded with the opening of the Hadley Centre at Bracknell. An active dialogue between the Agency and EUMETSAT for the definition of the second generation of meteorological satellites in geostationary orbit, due for launch in 1988, is currently ongoing.

The Agency's future programmes to provide Earth observation data using satellites and platforms in polar orbit will be initiated with the launch of Europe's first earth observation satellite, ERS-1 in early 1991 and extended with the launch of the ERS-2 satellite in 1994. The major task of the United Kingdom's industry in these two projects is to provide the Active Microwave Instrumentation, comprising a synthetic aperture radar and a wind scatterometer.

Another important instrument, the Along Track Scanning Radiometer, provided for the ERS 1 satellite by the United Kingdom, is funded nationally. This instrument will measure the temperature of the sea surface with unprecedented accuracy. Such measurements are crucial to the development of models of the climate and to the understanding of the relationships between the ocean and the atmosphere.

The organisations that participate either scientifically or industrially in the development of this instrument are:

- The Rutherford Appleton Laboratory.
- Oxford University.
- The Mullard Space Science Laboratory.
- The Meteorological Office.
- The Commonwealth Scientific and Industrial Research Organisation (Australia).

The procurement of a second flight satellite, ERS-2, and its complement of instruments will assure the continuity of observations. Both the satellite and its instruments are, as far as is possible, identical to ERS-1. The satellite will however carry an additional instrument designed to monitor the ozone content of the atmosphere.

In the context of these two projects and their successors the United Kingdom is establishing an Earth Observation Data Centre. This will act as a cornerstone of the United Kingdom's future satellite data processing capability. Initially, the centre will handle data produced by ERS-1 and ERS-2. Later it will provide the United Kingdom with the capacity to exploit data, possibly on a commercial basis, from the Polar Platforms and other missions planned for this decade.

The United Kingdom has also established a National Remote Sensing centre in 1980 to promote awareness of the value of satellite remote sensing data among potential users. The centre presently maintains archives of data from third party satellites, Landsat (USA) and SPOT (FRANCE), and acts as the national point of contact to the Agency's system for the acquisition and distribution of earth observation data.

It is to be expected that these two centres will be merged by 1992.

These national facilities provide the processing and archiving facility required for the exploitation of the data from ERS-1 and ERS-2. This facility has been funded jointly by the Agency and the Royal Aircraft Establishment, the latter being responsible for setting up and operating the facility.

Scientific support has been drawn from:

- The Royal Aircraft Establishment's Space Department.
- The Mullard Space Science Department.
- The Rutherford Appleton Laboratory.
- The British Antarctic Survey.
- The University of Leicester.
- University College London.
- The Institute of Oceanographic Sciences.
- The Marconi Research Centre.
- The Scott Polar Research Institute.
- The Meteorological Office.

Industrial participants include:

- British Aerospace (Space Systems).
- Software Sciences.
- SERCO.
- SD-Scicon.
- Logica Aerospace and Defence.
- Earth Observation Sciences.
- Vega Space Systems Engineering.

The United Kingdom has made significant investments in ground receiving stations. The Dundee satellite receiving station provides rapid access to AVHRR (Advanced Very High Resolution Radiometer) data and data products, and maintains a complete archive of Coastal Zone Colour Scanner and AVHRR data (from 1976 to the present). At Lasham the Royal Aircraft Establishment's station receives data from the NOAA series of satellites, and is a primary user station for METEOSAT, and a secondary receiving station for the American GOES-East meteorological satellite. The Royal Aircraft Establishment's West Freugh ground station, presently under construction, will receive synthetic aperture radar data from ERS-1 and later on from ERS-2.

In this context it should be recalled that the United Kingdom contributes 5.5 per cent to the Columbus development programme. (ESA's contribution to the International Space Station Programme). As a condition of entry, it was agreed that a significant proportion of this contribution will be directed to UK industry for the development of the earth observation element of the Columbus programme, the Polar Platform. The United Kingdom will thus be taking a leading role in this project with a 25-30 per cent share.

The Agency's new Polar Orbit Earth Observation Mission programme, which will use the Columbus Polar Platform and be the first of the series of programmes designed to do so, is expected to start later this year. This programme is strongly supported by the United Kingdom. The main objective of the first Polar Orbit Earth Observation Mission programme is to give Europe an enhanced capability for the remote sensing observation of the Earth from space. This will increase the capacity of participating States to study and monitor of the Earth and the environment.

The programme provides for:

- Monitoring of the Earth's environment.
- Observation of the atmosphere.
- Observation of the oceans and ocean ice.
- Operational meteorology from polar orbit.

The instruments to be flown will also furnish data relevant to the monitoring and the management of the Earth's resources.

This programme will continue and improve the measurements to be made by ERS-1 and ERS-2. It should also supply the means for Europe to take over partial responsibility for the provision of meteorological data from satellites operated by the US National Oceans and Atmospheric Administration (NOAA). Further environmental study capabilities, particularly in the area of the Earth's atmosphere, atmospheric chemistry, and its oceans will be provided. The programme responds to the fundamental requirement to ensure long-term continuous data. This data is essential for operational applications, and for addressing climatological and environmental issues.

The programme and its successors will also promote the gradual transfer from the experimental and pre-operational application of remote sensing data to their full operational exploitation.

Five different "core" instruments to be developed within the Agency's programme are supported by the United Kingdom. Particular interest has been declared in the synthetic aperture radar instrument, which the United Kingdom wishes to achieve as high a performance as is possible. A keen interest in playing the leading role in the industrial development of this instrument has been expressed.

The United Kingdom also supports the concept of including complementary instruments to be selected on a competitive basis using the Agency's Announcement of Opportunity procedure. It has proposed to develop two such instruments with national funding.

These are the so-called Doppler Wind Sensor (DWS) which would monitor winds on a global basis in the middle atmosphere, and an advanced version of the ERS-1 Along Track Scanning Radiometer (ATSR).

This latter instrument would not only ensure the continuity of very precise sea surface temperature measurements, but would also enable the vegetation to be monitored.

A possible contribution to this programme of between 25 and 30 per cent of the development cost has been indicated. This would be supplemented by the allocation of national funds to the development of the instruments proposed by the United Kingdom if selected for flight and national funding to manage and exploit the data produced.

The United Kingdom has also shown interest in hosting ground segment facilities associated with the Polar Platform, both in the area of spacecraft control, and payload data handling. British industry (Logica) has performed studies for the British National Space Centre (BNSC) using national funding, and discussions have taken place with Norway to determine whether existing ground station facilities in Norway could complement the UK proposed facilities, and so enable a joint proposal to be presented to the Agency for hosting some of the Polar Platform ground facilities.

Little interest has been shown in the United Kingdom in the Agency's gravity field mapping mission (Solid Earth project). During this Phase A study British Aerospace received 3 per cent of the work but subsequent studies have been executed without the participation of the United Kingdom's industries.

In summary, the United Kingdom is, and has always been a strong supporter of the Agency's Earth Observation programme in general, and of the Polar Platform and the programmes which will make use of it, in particular.

4. The advantages of hosting large facilities in the United Kingdom.

The Agency's member states host its Establishments (France, Germany, Italy and the Netherlands), some of its operational ground stations and satellite control facilities (Belgium, Germany, Italy, Spain and Sweden), and various small laboratories and specialised facilities.

In the early days of the European space programme, when the European Space Research Organisation (ESRO) and the European Launcher Development Organisation (ELDO) were created in the early sixties, the United Kingdom did not lay emphasis on the hosting of facilities. This position has recently changed somewhat, with the UK now showing an interest in hosting receiving stations, and control and processing facilities for earth observation missions, as explained above in section 3.

Hosting a major facility has been shown to lead to increased local employment associated with the operation and maintenance of the facility and to improve the opportunities for the host countries' industries to provide the technical installations for the facility.

The stability of the European programme also guarantees long-term employment and allows longer-term industrial relationships to be developed.

In many cases the availability of the facility provides a convenient opportunity to the host country to use it in the context of national programmes.

5. The use by the Agency of laboratories in the United Kingdom.

The Agency's Technical Directorate at ESTEC has promoted in the last 10 years the use of national laboratories to improve technological capability and the knowledge of specific disciplines. This has been done in those fields where the Agency does not wish to create its own capability.

There is a long standing relationship with the European Space Tribology Laboratory at Risley which specialises in space mechanisms. It studies for the Agency the tribology of brush materials, oils, greases, cryogenic tribology, lubricants and carries out long life testing of ball bearings and lubricants. A contract, negotiated every four years, ensures continuity and the maintenance of competence.

An amount of around £350,000 is contributed annually by the Agency to cover its share of the Laboratory's fixed costs.

A number of other laboratories in the United Kingdom have been used for specific tasks.

The Agency's Material and Process laboratory at ESTEC has contracts with British Aerospace (Stevenage) for out-gassing tests of volatile condensable materials, with the BNF (Wantage) for stress corrosion tests on metals and with Fulmer (London) for material analysis.

The ISIM of Salford University Business Services has received contracts from the Agency's Software laboratory at ESTEC for software simulation.

In the future there will be tasks in other disciplines that the Agency could wish to contract to national laboratories. These include:

- Laboratory testing associated with life support and habitability in space.
- The use of an accelerator facility for high energy protons and ions.
- The creation of an operational centre to support the users of the data produced by biological experiments in space.
- The use of a laboratory for software simulation.
- The use of a laboratory for expert systems with applications in the fields of biology and logistics.
- The use of a laboratory for computer visualisation and animation.
- And the use of a laboratory for product assurance.

Although the selection of these future laboratories will be made with some emphasis on the encouragement of small companies located in those member states making a smaller contribution to the Agency's programmes, and experiencing difficulties in achieving an adequate industrial return on their contribution, this will not exclude the selection of laboratories in the United Kingdom with established specialisations and proven competence.

6. Geographical Return Considerations.

A basic consideration for the Agency's programmes is the concept of "fair return", under which industry in each member state should receive contracts of a value corresponding to their contribution, not in absolute terms, but as a percentage (e.g., after deduction of Agency internal costs, etc.). Thus with a United Kingdom contribution to these two categories of programme amounting to 33.2 million pounds sterling in 1990, representing 12 per cent of the total contributions of all member states, an amount representing 12 per cent of the total payments to industry in 1990 should go to the U.K. This is an over-simplification but illustrates the principle.

Such has been the success of the United Kingdom's industries in winning, against competition, development contracts in the scientific programme that the value of work placed has frequently exceeded the United Kingdom's financial contribution. Coupled with this, the provision (relying on national funding) of advanced scientific payloads to the programme provides the national aerospace industry with additional important opportunities for commercial endeavour and technological development.

Evidence from the Fellowship of Engineering

The Fellowship of Engineering wishes to comment on five of the nine questions posed by the Sub-Committee in connection with its enquiry to consider how the United Kingdom responds to proposals for international scientific programmes.

Being a collation, the following paper cannot reflect the views of all contributing Fellows nor those of The Fellowship as a whole. It may, however, be regarded as representative.

SUMMARY

1. Participation in International Scientific and Technological Programmes may be motivated by the need to achieve strategically co-ordinated overseas contacts, to acquire technology, develop business interests and to reduce costs of commissioning and operating expensive research programmes.

2. International programmes should be developed to achieve strategic goals for United Kingdom science and technology and should not be approached in a piecemeal or half-hearted fashion.

3. It is considered desirable for active research groups in the United Kingdom to participate in ISPs to maintain international prestige.

4. The principal advantages of participating in ISPs are the reduction in costs to acquire results, provision of a better balance of resources and the achievement of a "critical mass" in some areas with results drawn from a wider international base. Collaborative strategies can help build up knowledge by inward technology transfer, create international contacts and help people become familiar with working in an international environment.

5. Disadvantages of participation in ISPs include the need to compromise in defining the programme and loss of flexibility for participants to adjust to changes such as currency fluctuations. Increased overhead costs are required particularly to find partners with a genuine contribution to make and the timescale may be extended due to the requirement for cross-reporting and progress meetings to ensure coherent execution.

6. The benefits of hosting major facilities are perceived as improvements in local infrastructure and employment prospects, with potential for economic growth around the nucleus of the facility. The need to fund such facilities over long periods in competition with national research programmes is regarded as a constraint.

7. The machinery for programme definition and approval developed for the EC Framework Programme is regarded as effective, but other international programmes are considered to involve excessive bureaucracy. Government departments, industrial companies and research organisations should make more constructive responses to information consultations from the European Commission.

8. The criteria against which proposals are judged are scientific or engineering excellence, the perceived future potential of the programme and the cost-effective minimisation of the resources required. Concern is expressed about the scrutiny of proposals from industrial consortia by bodies consisting largely of academics and government officials.

9. HM Treasury rules in UK on attribution appear to recieve greater emphasis than those which apply in other EC countries. This leads to UK participants in EC initiatives tending to feel more threatened by automatic withdrawal of funding than is the case for scientists and engineers in other EC countries. If these rules are tightened they pose serious problems by reducing the funding available to national programmes and could lead to difficult decisions on the merits of joining ISPs or maintaining national programmes, particularly in fields where the UK is advanced in technology.

General Comments and Background

Participants in International Scientific and Technological Programmes may be motivated by a number of factors which include:

- A wish to achieve a connection between research in different countries which is closer or more strategically co-ordinated than that which would be fostered by the usual process of scientific publication and discourse.
- As a part of a strategy for the acquisition of technology and the development of business interests.
- To reduce the costs to any one participant of acquiring and operating an expensive research facility or programme.

The questions of financial criteria and investment appraisal are important in relation to the last point. However, international programmes should be developed as part of the process of achieving strategic UK goals in science and technology, not merely embraced in a piecemeal or half-hearted fashion. Five of the specific points raised for comment are discussed below. Fellows of The Fellowship of Engineering had no comments on points (v), (vi), (vii) and (ix).

(i) *Advantages and Disadvantages of Joining ISPs*

In general, it was considered desirable for active research groups in the United Kingdom to participate in international programmes to maintain their prestige in the international community.

The following *advantages* have been highlighted:

- Reduced cost of acquiring the results of desired research and investigations.
- Achievement of critical mass in fields of research where individual national efforts are of sub-critical size.
- The acquisition of research results from a wider international base than those derived from national effort.
- The provision of a better balance of resources, skills and facilities allowing a wider programme of research.
- The nation may use a collaborative strategy to build up “know how” in technologically “weak” areas, thus gaining inward transfer of external expertise.
- Creation of inter-personal and inter-organisational linkages and the cross-fertilisation of ideas.
- The negotiation of an international programme may enforce the clarification of national research policies.
- In the context of the need to trade internationally, the programmes help people become familiar in working in an international environment.

Disadvantages cited included the following points:

- Increased overhead costs especially relating to travel and translation.
- The need to compromise in defining the programme which may result in a less than ideal programme seen from any individual national viewpoint.
- Loss of flexibility for individual participants to adjust to subsequent changes of national circumstances such as currency fluctuations, inflation indexation and local salary negotiations.
- The bureaucracy of setting up and managing programmes including finding politically advantageous partners who can make a genuine contribution.
- In the definition of programmes, pressure groups may form to seek to drive the research in a particular direction to their own particular advantage, or conversely, teams may be formed on the basis of false perceptions such as the participant being a nation perceived as “under-represented” in the collaboration. Government departments may have the disadvantage of being drawn into grandiose programmes by other governments motivated by prestige rather than financial analysis and pay-back time.

- International programmes may need an extended timescale compared to national programmes and require more cross-reporting and progress meetings to ensure coherent execution.

(ii) *The Advantages and Disadvantages of hosting Large Facilities*

The benefits of hosting large facilities were perceived as improvements in the local infrastructure, employment prospects and stimulus for the local economy, with potential for further industrial and commercial growth around the nucleus of the facility.

The European Transonic Wind Tunnel (ETW) at Cologne is a current example of a collaborative investment (by UK, France, Germany and the Netherlands) which is seen by West Germany as a major foundation in the policy of building up the Aerospace Industry in North Rhine Westphalia. The West German Government and Lander will pay an additional premium, (38 per cent of construction costs as compared to 28 per cent contributed by France and UK), in recognition of such benefits.

The benefits of improving technology for local industry are illustrated by the effects on magnet and coil design and manufacture that has resulted from the Joint European Torus (JET) in the United Kingdom.

The disadvantages of large facilities include the commitment to provide funds over a number of years from limited budgets which also fund national programmes. UK participation in particle physics and astronomy has been funded from a single budget which also supports engineering and technological research. UK commitment to participate in these international scientific programmes is perceived as disadvantageous to technological research, in that it requires funds in competition with engineering research from a single budget, and currency fluctuations associated with funding large facilities over long periods may exacerbate the impact on the funding of engineering and other programmes.

(iii) *The Machinery used to establish International Programmes*

The comments relate mainly to European Communities' (EC) programmes which have elaborate and well documented procedures for programme definition and approval. The UK Government is fully involved, with the Cabinet Office playing a pivotal role, in all stages of discussion and approval of the Framework Programme and the ensuing specific programmes where EC research is defined and authorised. The machinery developed by the EC for Framework Programme is regarded as an effective institutional form. By contrast, if the activity is one which ultimately co-ordinates a number of individual programmes each with its own national funding, such as EUREKA, the bureaucracy involved is regarded as excessive.

There is one key phase in the EC process which is not closely prescribed. This is the work done by the service of the Commission of the European Communities on preparation of programme proposals prior to their formal adoption by the Commission. By definition, this work cannot be the object of formal consultation of Member States administrations. At the same time, it is in the interest of all parties that the formal proposals which emerge from the Commission should be based on a thorough understanding of the situations and opinions of national administrations and of research organisations and companies which would be involved in any proposed work. To this end, it is important that departments, industries and research organisations should make an active and constructive response to the informal consultations which the Commission habitually undertakes, not only in institutional settings such as the CREST Committee but also in *ad hoc* groups such as the "Senior Officials Committee" and the Industrial Round Table "Executive Committee" which operated prior to the launch of the ESPRIT information technology programme.

(iv) *The Technical and Financial Criteria under which ISPs are Presented and Considered*

The technical criteria against which proposals are judged are scientific or engineering excellence and the perceived potential value of the work proposed. The financial criteria have normally referred to the cost-effective minimisation of the resources to be expended to achieve the declared goal of the ISP.

Consideration by potential participants is likely to include the following factors:

- The value of the results likely to be secured.
- The indirect value of co-operation such as new contracts.
- Conformity of the proposal with the business or academic priorities of the participant.
- The availability of material, personnel and financial resources.

Concern was expressed about the scrutiny of proposals from industrial consortia by selection bodies consisting largely of academics and government officials. These experts may not have a clear idea of the financial implications of their decisions and may impose unrealistic financial constraints in suggesting amendments to programmes.

(v) No comments

(vi) No comments

(vii) No comments

(viii) *Impediments within the UK to engaging in ISPs*

The impediments outlined below are not experienced uniquely by the United Kingdom, but do contribute to the administrative difficulties listed under (i).

The philosophical principles upon which HM Treasury rules on attribution are based are unexceptionable but their operation does sometimes have negative consequences, particularly in the European Communities (EC) context. Emphasis upon the attribution principle tends to appear much more conspicuous in the UK than in other EC countries. There is a tendency for potential UK supporters of EC initiatives to feel more threatened by automatic withdrawal of national funding than is the case in other countries. If these rules are strictly enforced they pose serious problems by reducing the funding made available to other national programmes. Any tightening of the rules in this direction will lead to difficult decisions on whether it is better to join an international programme or maintain a national programme, particularly in an area where the United Kingdom is advanced technologically.

EC programmes provide only partial support and thus it is important that national programmes are geared to provide the counterpart funds. National bodies, including government departments, need to be more pro-active in publicising their role in supporting selected international programmes. Officials may be helpful when directly approached, but their role is largely passive. Higher Education Institutions (HEIs) receive regular announcements about the EC programmes, but there is a lack of information on whether there is corresponding national support available.

Intellectual property rights (IPR) are a difficult issue when engaging in international programmes. It sometimes appears that a declared objective for international collaboration is technology transfer to smaller countries or to small or medium-sized companies. Without appropriate IPR there is reluctance to bring sensitive information to a collaborative venture. This is not merely a question of distribution of royalties, but also of advantageous, or even exclusive, rights for participating companies. There may be other strictures on exploitation of the results, especially if immediately exploitable results, such as software, are produced.

An example of the need for careful consideration of IPR is the field of medical electronics. British science contributed significantly to the research and development of medical ultrasound, computerised tomographic X-ray and nuclear magnetic resonance but the UK government and industry lost the resulting opportunities to the benefit of overseas companies. Thus IPR should be tackled in the UK with the skill and tenacity of our foreign collaborators.

(xi) No comment.

Evidence from Ferranti International plc

EXECUTIVE SUMMARY

Item numbers refer to the relevant paragraph in the main document.

- (2) An important benefit from recent programmes has been the re-establishment of links between industry and the academic community.
- (3) Research is often of more benefit to the country than to the industrial organisation undertaking the work. There is therefore a good case for government funding.
- (4) Rules for participation should be re-examined with a view to improving value for money.
- (5) In projects leading to standardisation, consensus may be more important than efficiency.
- (6) The expertise of users is important. There should be more emphasis on user involvement.
- (3, 4, 5) Results of funded research should be made widely known. Benefit derives from use of results, not the research itself.

1. SCOPE

Comments in the paper are, in the main, based on experience gained from participation in recent and current Research and Development programmes for the Information Technology industry, operated by the British Government (DTI) and the European Commission.

2. THE BENEFITS OF RECENT PROGRAMMES

The main benefit derived from recent collaborative programmes, particularly the Alvey programme at home and the ESPRIT programme in Europe, has been the revival of links between industry and the universities, after many years of drifting apart. The ESPRIT programme has also stimulated contact between companies in different European countries, that in some cases has led to collaborative commercial ventures.

3. THE BENEFITS OF RESEARCH IN GENERAL

A recent paper "Long Termism" by Richard Freeman, Corporate Chief Economist of ICI plc, published by the British Management Data Foundation is of interest.

Freeman shows that:

- (a) National economic performance is best in countries where there is a high level of research expenditure.
- (b) Companies showing the highest profitability in the short term are not necessarily those doing the research. In fact they are more likely to be those using the results of research done by others.

Two conclusions suggest themselves:

- If it is in the national interest for research to be done, but not necessarily in the interest of companies to do it, there is surely a good case for governments to make research attractive either by funding it or by other means.
- If benefit derives from use of research, rather than doing it, information flow from researcher to user is very important and should be seen as a major element in any publicly funded scheme.

From the viewpoint of industrial participants, only the biggest and wealthiest companies can afford to engage in privately funded fundamental or early-stage research on more than a token scale. The availability of public funds is therefore an important stimulus to this type of research and collaboration has a valuable gearing effect.

4. RULES FOR PARTICIPATION

Rules for participation in European programmes sometimes appear to be prompted more by social engineering aspirations than by the requirement for good research. Examples are the criteria applying to the number of partners in a project and the need for cross-border collaboration. If it is accepted that the main benefit derives from the use of results, perhaps participation rules can be weakened and replaced by a requirement to communicate results widely and openly and to make intellectual property rights available under licence at a reasonable price.

5. LARGE PROJECTS

There is one class of project in which it is beneficial to have a large number of participants.

These are the projects in which the objective is to establish standards. The presence of a large number of collaborators, although possibly somewhat inefficient from the viewpoint of actual research, increases the likelihood of consensus and eases the route toward international standardisation.

6. THE IMPORTANCE OF USERS

Both national and international schemes for the information technology industry in the recent past have been heavily biased toward pre-competitive or pre-normative research. There have been criticisms that too few projects have led to successful commercial exploitation but it must be accepted that when undertaking early-stage research:

- (a) The decision that a particular approach is unproductive and should therefore be pursued no further is a perfectly valid result, and therefore a successful result.
- (b) The cost of progressing from research to exploitation is very high compared with the cost of the bare research and may not be justifiable in terms of the risk involved and the anticipated rewards.

It is gratifying to see that some of the European schemes (e.g., ESPRIT II) are moving their emphasis toward exploitation but, nevertheless, there still seems to be a failure to recognise the importance of involving potential users of the results in such projects. It is our belief that a partnership between a developer and a user can be a very powerful combination and more likely to lead to a successful conclusion than partnerships composed of developers alone.

7. SPECIFIC ISSUES

On the specific issues raised on the letter of 8th June.

- (i) The advantages and disadvantages of joining ISPs

To the UK

- The country's store of knowledge is increased, which must be beneficial.

To the funding department

- No comment.

To the participating body

- The ability to gain knowledge that would otherwise not be gained.
- A multiplication effect of resources due to collaboration.
- The possibility of reaching consensus on international standards.
- The possibility of establishing collaborative exploitation.

- (ii) Large facilities (hosting)
 - To the UK
 - Brings in sources of knowledge and expertise that can be spread through links with local institutions.
 - Brings opportunities, for high grade employment, thus developing experience.
 - Brings income from international visitors.
 - Transfers technology to local industry.
 - To funding department
 - No comment.
 - To participating institution
 - The opportunity to become a centre of excellence.
- (iii) Machinery for setting up international programmes

European programmes in Information Technology appear to be set-up by the European Commission in close consultation with Europe's largest companies. Thus they reflect the interests of these large companies and others have little opportunity to influence them.
- (iv) Technical and financial criteria—no comment.
- (v) Forum for decision to participate—no comment.
- (iv) Government practice and guidelines—no comment.
- (vii) Additionality and Attribution
 - In national programmes the additionality rule decrees that support can only be given to projects that would not be carried out (or not on the same scale or in the same time) without public funding. This naturally removes all the best projects from consideration and biases schemes toward second rate contenders.
 - At international level attribution, the offsetting of any funds gained against those available for domestic programmes, coupled with a diminution of national funds, is having the effect of reducing support for national schemes to negligible proportions. This is a pity because national schemes can be tailored to address national strengths and weaknesses, whereas international schemes must, of necessity, be of a more general nature.
- (viii) Impediments within UK—no comment.
- (ix) Impediments in other countries—no comment.

Supplementary Evidence from the Foreign and Commonwealth Office

A. SCIENCE COUNSELLORS

(i) Do Science Counsellors see it as part of their job to look out for opportunities for UK participation in ISPs?

Yes. One of the tasks of Science Counsellors is to identify opportunities for international collaboration. This may take the form of putting people in touch with one another or of reporting scientific developments of interest to potential partners in the UK.

Proposals for ISPs are usually developed over a long period, and are widely discussed between potential participants in a variety of fora. We therefore often have considerable notice of proposals and opportunities to influence them before implementation.

(ii) To what extent do Science Counsellors offer advice to ensure that any approaches for collaboration are directed to the appropriate UK body?

The formal arrangement is that scientists and government departments in other countries look to their own Science Attaches in London for advice and assistance in collaboration with UK bodies. The main flow of advice from UK Science Counsellors is, correspondingly, to UK Government Departments and Research Councils. In practice however Science Counsellors do occasionally receive approaches for collaboration. They respond by putting enquirers in touch with appropriate interlocutors in the UK. Most research organisations in major competitor countries however already know their British counterparts well and have adequate contact with them.

Initiatives for collaboration also arise from a wide spectrum of other multilateral and bilateral contacts with partner countries. Such discussions are held at Ministerial, Chief Scientist and other official levels. The recent UK/FRG Round Table on Research Policy, which was held in Bonn in September 1990, provides a good example of these valuable exchanges.

(iii) How much time, if any, are Science Counsellors able to give to monitoring the activities and efficacy of existing ISPs, in particular those involving large facilities within their country?

Responsibility for monitoring the performance of international scientific organisations/installations lies with the lead Department/Research Council (in consultation with other interested Depts) in the UK. The role of Science Counsellors is to report on the policies and attitudes of their host government towards the ISPs. Science Counsellors may however become involved in negotiations and exchanges on ISPs, when proposals are being formulated or at times of difficulty or dispute. They do, course, monitor the development of bilateral co-operation closely.

B. NATIONAL ATTITUDES

(i) What is the attitude of the competitor countries to collaborating through international scientific programmes and, in particular, to the hosting of large facilities?

This varies and it is impossible to give a general response. For example ISPs occupy an important position in French S&T policy. France is active in proposing new projects, and has been keen to host facilities (ESRF, ILL, ESA, HFSP, etc.). Bids to host these ISPs are often supported (politically and financially) by regional authorities.

The West German government encourages international co-operation, but not necessarily at any price. Although the FRG bases its collaboration on scientific considerations, it also takes into account political, commercial and cultural factors. Attitudes towards hosting large facilities depend on their relevance to German research activities in the area. The Länder may also contribute funding to attract large facilities.

Italy has a strong tradition of international scientific co-operation and is an enthusiastic contributor to multilateral ISPs. It hosts the largest of the EC Joint Research Centres (Ispra) and the ESA Satellite Co-ordinating facility (ESRIN).

Until recently the USA had not seriously considered international collaboration in the civil field. This may have stemmed from a view that it led the world in most areas of science and technology and had little to gain from collaboration. There are signs that this attitude may be changing (although Congressional exchanges over the Space Station "Freedom" show that it may take some time for a truly international approach to take root). An attempt is being made to secure overseas financial support for the construction of the new Superconducting Super Collider—but well after the project planning and decision stages.

Japan's attitude to multilateral ISPs is generally cautious, perhaps reflecting its comparatively recent participation in them. It is placing much store on the progress of development of the Human Frontier Science Programme, which it initiated. The Japanese are however well-disposed towards co-operation with the UK and with British scientists. Bilateral collaboration is increasing as a result of the UK/Japan Round Table chaired by the Chief Scientist in London in 1989. A further meeting is planned in 1991.

Canada has extensive international links in scientific research but limited involvement in multilateral ISPs.

(ii) What are the national funding arrangements for participation in such programmes and how do they differ from those of the UK?

In France decisions on funding rest ultimately with the Ministry of Research and Technology. EC R&D is funded separately. Other civil scientific organisations/programmes have independent budgets—two arrangements basically apply:

- (a) Government Departments (e.g., Ministry of Foreign Affairs, Ministry of Transport) fund some (e.g., EMBO, ESO, CERN, Meteosat and ETW);
- (b) Others (e.g., ESRF, ESA, ODP, etc.) are funded by the participating research organisation (CNRS, CEA, CNES, IFREMER, etc.).

In Germany the BMFT (Research Ministry) funds specific scientific projects from separate funding lines in its budget, which requires parliamentary approval. Space collaboration is an exception: the budget is set by BMFT but administered by DARA (German Space Agency). The Ministry of Finance funds EC R&D separately, although the BMFT remains responsible for policy. In principle ministries are required to make a budgetary contribution to EC activities in their sector when it is agreed that national and EC activities together have reached the limit of what is desirable. Other ministries (Defence, Economy and Education and Science) spend significant sums on R&D. The Max-Planck Society and the Deutsche-Forschungs Gemeinschaft both have considerable autonomy in setting expenditure priorities.

In Italy most research activity is funded through the Ministry of Universities, Research, Science and Technology in accordance with guidelines set by the Interministerial Committee for Economic Planning. In practice the research organisations enjoy a good deal of autonomy in financial matters. Funding arrangements for ISPs vary. For example, the Italian Space Agency funds ESA; the National Institute for Nuclear Physics funds CERN; and the Ministry of Trade and Industry funds EURATOM.

American funding arrangements have not had to be adapted to take the needs of international collaboration into account. If the USA is to make commitments to international partners, Congress will have to reassure them about its willingness to guarantee funding over a number of years. Hitherto this has been a serious barrier to international commitments of a multi-annual nature.

Canada has no central funds to support ISPs. Limited funds are made available on an *ad hoc* basis to support particular programmes.

(iii) What institutional or cultural impediments are there in competitor countries which militate against their participation in ISPs and how do they bite? For example:

- (a) Intellectual property rights.

- (b) Commercial secrecy/COCOM.
- (c) Protectionism.
- (d) Annual budgetary procedures (esp USA).

There are few, if any, cultural or institutional impediments in France. Although annual budgetary problems can occur there, they rarely affect major international scientific projects and programmes. COCOM rules apply equally to most of our major competitors. They may have imposed limits on the FRG's collaboration with Eastern Europe; but the COCOM restrictions have recently been relaxed, especially with respect to the GDR.

Italian participation in ISPs can be affected by a number of cultural and institutional problems. Parliamentary procedures, for example, may delay funding.

The Americans attach considerable importance to protecting Intellectual Property Rights and to avoiding leakage of technology in strategic areas. But collaboration involving universities or academic research bodies is quite open and unaffected by considerations of protectionism.

Evidence from General Technology Systems Ltd

(i) The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions.

There is an advantage in an organisation joining an international scientific programme (ISP) if the collaborative venture is properly designed to the point that the contribution of expertise made by the UK can be a constructive element of the overall international work, and that the UK can have access to a broader and deeper resulting research activity than had the programme proceeded on a single national funding basis.

There is a commensurate advantage to the funding department in that for a given expenditure a broader international base of experience is available, and the institutions clearly benefit if the criteria indicated above are met. It should be remembered that the management of multi-national/multi-organisational projects is a substantial non-recoverable cost.

Advantages

Since we are considering scientific programmes, unclassified and non-commercial, *eventual* access to the results of research might reasonably be expected to be made available whether we in the UK are in or not. (An argument often used for non-participation). However, by joining, the UK:

- Has immediate access to the results of ISPs, of use should they be exploitable in a commercial, economic manner.
- Keeps the scientific community with hands-on experience in projects which, as an individual nation, we could not afford. This enables our scientific community to perform at an international level, rather than in a limited community. The time has largely passed when experiments such as those of Otto Hahn on the fusion of uranium could be conducted on apparatus costing a handful of dollars.
- Participation in international programmes allows our scientists closer contacts with their peers in other countries, assisting in flow of ideas and experimental results on a much wider basis than the specific ISP itself. Non-participation in the great scientific advances; except as readers of the literature could reflect adversely on a nation's prestige—and hence eventually orders for its technological products.

Disadvantages

- ISPs tend to be "big science", mopping up a considerable resource, even of each individual participating country. If the resource is drawn (as it usually is) from the public "science budget", individual national research projects, of a size capable of being conducted on a smaller resource basis, tend to be starved of resources. "Small science" suffers at the expense of "big science". (This is a perennial SERC complaint).
- A corollary is that scientific resources, in terms of manpower, could, through the employment of a significant portion of each nation's scientists in a particular discipline, lead to fewer scientists working in a "free" environment of scientific exploration, and hence a reduction in new individual ideas. Indeed, in the bandwagon of thought on an internally researched topic—the "deviant" thinker is less likely to be heard. (Example—the ozone layer hole story).

It is important to balance the available resource between national and international projects to both benefit from advances in larger-scale projects and at the same time promote adequate diversification of ideas.

(ii) The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution.

There can be an advantage in hosting large facilities if the resulting entity attracts additional infrastructure and is serviced over a long period by a team of international experts who bring, not only their experience, but their spending power.

Much depends on the financial structure of the organisation who owns the facility. An injudicious arrangement can mean that the facility once established can count towards the "juste retour" recovery by the country in the international programme to the detriment possibly of noble work.

However, the advantages should be able to outweigh the disadvantages in general, since the development of what is effectively a centre of excellence if properly handled can only be good for the UK.

Advantages

To the funding department. Generally, not very important: avoidance of travelling costs (unless this advantage accrues to the hosting institution!).

To the hosting institution. Generally, considerable. It expands its own facilities in the area concerned, in that access for its own scientists is greatly facilitated, it increases its teaching capability in the discipline concerned, and it acts as a focus for other facilities in and around the campus.

Disadvantages

Although internationally financed, the cost share of the facility tends to be greater for the host country (and hence department).

For the hosting institution also there may be a marginal disadvantage in that the facility may channel too large an academic interest in the discipline concerned, at the expense of other activities. Good management should prevent this happening, however.

Though the funding department may suffer some financial disadvantage, the country, or at least the area in which the facility is located, benefits considerably in the supply of “infrastructure” services for the international scientists involved and other supporting services.

(iii) The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate.

(iv) The technical and financial criteria under which proposals for ISPs are presented and considered. No detailed comment is offered on the question of the machinery, technical and financial criteria and the adequacy within the UK.

Is there a standard pattern?—we doubt it. GTS suppose the main issue is—do our UK scientists have enough say in the objectives of ISP’s and the level of UK participation? Are decisions sometimes made for political reasons rather than purely scientific?

One has to be very cautious about relying purely on a scientific input. Much of our international space science activity would not be supported by UK scientists, given a free hand—they would want funding of small projects in their own universities!

(v) The forums in which the decisions to participate in ISPs is normally reached.

With regard to forums where GTS personnel have been involved, there is often a high quality of individual representation, but *numerically* the UK is frequently grossly outmatched by other countries who have thought through carefully before the meetings the nature of what they seek to achieve. Others are frequently quite ruthless in the way they achieve their objectives. The British are far less prepared, more passive and generally less successful.

(vi) Government practice and guidelines on ISPs—how they apply and how widely they are known and accepted.

In general, GTS believe that the government practice and guidelines (if such exist) on ISP’s are less well known and accepted than is desirable. Whilst some structure has been set up to allow the dissemination of information, the UK in general does not demonstrate high efficiency or success in leading and influencing many international scientific programmes.

(vii) Treasury rules of additionality and attribution—how they apply in respect of ISPs and the Science Budget and how they treat inflow of foreign money.

Treasury rules have been fatal to opportunities for UK participation in some ISPs—a point made several times—as they come out of total science budgets. They have the effect of damaging national programmes and are thus opposed by the scientific community.

(viii) —No comment.

(ix) —No comment.

Letter to the Clerk from Roy Gibson

Thank you for your letter of 25 June. The subject is so wide that it is difficult to offer advice without it being either platitudinous or special pleading. I should therefore like to concentrate on a small number of points which, hopefully, avoid these two characteristics.

(1) Fundamental to a wise decision on whether or not to join an ISP is the early creation of a competent national group to evaluate the proposed programme and to examine alternatives. At this stage it might still be possible to influence the programme more in the direction of the UK’s interests.

(2) Send a first class team as early as possible to participate in the formulation of the programme. Do not rely solely on voluntary or *ad hoc* for this phase: good advice costs money.

(3) An early decision, at least in principle, gives the negotiators more influence and the possibility of maximising the value of participation. Vacillation and uncertainty, particularly during a period where the UK is so often—especially in Europe—considered as a spoiler, is worse than a clear negative decision.

The whole thing needs to be planned as an operation, rather than as a series of seemingly unconnected meetings and discussions, with the science community thoroughly puzzled by the decision-making process.

Yours sincerely,

Roy Gibson.

**Letter to the Clerk from Professor Sir Francis Graham-Smith FRS, Astronomer Royal,
Langworthy Professor of Physics, University of Manchester**

Dear Mr Walters,

INTERNATIONAL SCIENTIFIC PROGRAMMES

Your call for evidence on ISPs may already have received a detailed response from SERC, but I would like to point out some particular aspects of international co-operation in ground-based astronomy which may be of interest to your Sub-Committee.

There are three major sites involved, each with its own peculiarities. In each case the driving force has been the geographic location, for example, Australia provides access to the southern sky, and the Canary Islands provides the best location for European observers working in the northern hemisphere. Also in each case partnerships have been built up between the owners of the site and the visitors, who are predominantly from the UK. Others have subsequently joined in as partners, contributing both funds and expertise.

The Anglo-Australian Observatory is an equal partnership, funded as an independent entity, which operates a 4m telescope and a Schmidt survey telescope on Siding Spring mountain in NSW. It is governed by a Board which enjoys a remarkable degree of independence. Both telescopes have been outstandingly successful.

Mauna Kea, Hawaii is the site of two SERC telescopes, for infra-red and millimetre waves. In both there are international partnerships, and both are run directly by SERC.

La Palma, Canary Islands is a Spanish site now used by several European countries under the umbrella of an international agreement. The UK provided the initial proposals, and has put in the major part of the telescope complex and instrumentation. This is a growing co-operation, already involving eighteen different institutions. The UK part is run by the Royal Greenwich Observatory.

The La Palma agreement is based on the minimum exchange of funds: Spain provides the site, and we provide the telescopes. Observing time is divided according to general principles by an international committee.

The Anglo-Australian Observatory is funded equally from both sides.

On Mauna Kea the agreement is similar to that for La Palma; the UK provides observing time in exchange for the use of the site.

All these were set up through the initiative of the astronomers who were directly involved. SERC can provide the details, including an analysis of the success of the three observatories both scientifically and in promoting international co-operation and the development of scientific research in countries such as Spain.

I would be very happy to expand on these notes if you wish for more detail, but I believe your purpose will be best served by obtaining reports from SERC. My own particular contribution was in the establishment of the La Palma Observatory, and I could give some account of the way in which we developed the agreements with Spain.

Yours sincerely,

F Graham-Smith

**Letter to the Clerk from, Professor H C A Hankins, Principal, University of Manchester Institute of
Science and Technology**

Thank you for sending me a copy of Mr Walter's letter dated Friday 8 June addressed to the Chairman of the CVCP, requesting a response by the 20 July. I am limiting my general reply to those areas in which UMIST has enough experience on which to base a judgment and these areas fall mainly into categories (i) (iv) (vi) and (viii) indicated in the 8 June letter. I have previously given my views on the question of additivity (category vii) to the European Communities Committee in a letter dated 12 April 1990.

UMIST considers the advantages of joining ISPs to be those of increased opportunities to forge international links in order to enhance the UK's and UMIST's skills, to create significant research activities where they might not otherwise happen on such a scale, to create synergy and also to learn first hand about research being undertaken overseas which increases our knowledge base and avoids duplication. The funding department benefits by gaining full knowledge of the results of the programmes it supports, but often does not have to support the true full costs of the programmes, i.e., the programmes are cost sharing. The funding department plays a critical role by facilitating these programmes through its financial stimulus.

From its experience, UMIST considers the technical criteria under which proposals are presented and considered to be satisfactory. When initial details and guidelines are unclear, it is usually an easy exercise to contact the international programme managers and establish the position. There have been some worries about the confidentiality aspects of revealing unpatented ideas in proposals and researchers should be reassured by the requirement for assessors to sign binding confidentiality agreements and for proposers to be made fully aware that this will always be done. When evaluating BRITE proposals (Basic Research in Industrial Technologies for Europe), the European Commission invites all the evaluators to one location (usually Brussels for obvious reasons) and the whole assessment is carried out in that one location, i.e., no proposals are sent out of the Commission and no notes or copies are allowed to be taken away at the end of the assessment period. Academic researchers at UMIST think this is good evaluation practice and would like to see it used more widely, when practicable.

Financial problems can occur when the basis on which universities participate is made the same for all universities from each country. These problems arise because national governments fund their own universities differently. An obvious example of this is the criterion for universities engaging in European Commission supported programmes on the marginal cost basis. The model allows for universities to recover all marginal costs plus a 20 per cent overhead and whereas, for example, German universities find this very acceptable because of the way they are funded by their regional and national governments, British universities are not recovering their costs which are, as you will know, at least marginal costs plus a 40 per cent overhead. Therefore these sort of considerations should be thoroughly taken into account when deciding the financial basis of university participation in ISPs.

UMIST usually becomes aware of ISPs by watching for programmes in relevant journals and by the receipt of details from Government Departments, British Council, Research Councils and the European Commission information organisations. In the last 18 months UMIST has established a limited company (UMIST VENTURES Limited) which *inter alia* has a responsibility to find out about ISPs at an early a stage as possible and then works closely with academic and related staff to assist them in submitting research proposals. Since UMIST VENTURES is international in its outlook and has a formal network of overseas partners, it is helpful to UMIST's early knowledge gathering system regarding current and forthcoming ISPs. UMIST's Director of International Relations performs the same type of role for those ISPs that are particularly related to the exchange of staff, students and information. Therefore because UMIST has organisations tasked with this responsibility, coupled with the existing information dissemination activities by those bodies aforementioned, the ISPs are familiar to, and well regarded by, UMIST.

Generally speaking there are some minor barriers to engaging in ISPs, but these are often decisions made at a personal level. UMIST does not have a policy of restricting participation because, for example, it cannot predict currency movements. One "barrier" to participation is that of language, a small number of British people (especially with student exchange programmes) are not keen to work abroad in non-English speaking countries because they have difficulty with certain languages. Commercial secrecy and exploitation of intellectual property rights issues do not present problems. UMIST (through UMIST VENTURES Limited) is well experienced in these matters and always ensures that UMIST and the collaborating partners have an appropriate and reasonable commercial relationship and no ISPs have been discouraged or limited because of concerns of this nature. The commercial view has to be balanced against the advantages of participating in the research itself and of being able to mix with researchers of high standing from other countries.

I hope that this letter will be helpful to the Sub-Committee.

Yours faithfully
H C A Hankins

**Evidence from Dr R M Harrison, Department of Chemistry and Biological Chemistry, University of Essex
Environmental Sciences**

My experience of international scientific programmes relates to environmental programmes organised by the European Commission. These have been running for a good number of years now and have a fairly good track record of fostering international collaboration. Increasingly, environmental research is recognising the irrelevance of national boundaries to the majority of pollution problems, and international effort is essential to the effective solution of these problems. The EEC programmes encourage collaborative proposals and are unlikely to be funded unless they involve laboratories from a number of different countries. The problems that arise for UK scientists participating in these programmes are that there is no co-ordinated means of disseminating information on the programmes themselves and the deadlines for applications; the difficulty of briefing UK representatives on important committees so that they may argue most effectively for the

funding of UK proposals; and the fact that the Commission appears never to award the full sum of money requested and that it is often then necessary to raise supplementary funding from within the UK, which can be very difficult. There have never to my knowledge been mechanisms in the UK whereby this money is available as of right.

A non-EEC-run programme which has fostered some very valuable collaborative research is the EUROTRAC environmental project which comes under the auspices of EUREKA. Whilst UK research groups are playing a major part in this programme, it has been relatively difficult to raise funding within the UK. There is no central pot of funds for EUREKA projects and, whilst in Germany all approved EUROTRAC work is automatically funded, in the UK and indeed in a number of other countries there is no automatic right to funding or indeed necessarily any preference obtained in funding applications.

A relatively new international programme which is presently still at the stage of formulation is the International Geosphere Biosphere Programme. This programme, which contains projects such as the International Global Atmospheric Chemistry project, is an enormously important environmental research programme for which in the UK the Royal Society has set up a committee. However, there are no UK funds directly available for IGBP, and the UK contribution paid through the Royal Society is rather small. Whilst there is immense enthusiasm in Universities, Polytechnics and Research Institutes for collaboration in the IGBP, there are no straightforward routes of research funding and this is a great disadvantage. Given the importance of some of these international programmes, it is unfortunate that no central government or Research Council funds are earmarked specifically for collaboration in them.

In summary, I believe that international environmental research programmes are extremely important but that UK participation has been limited in the past by the shortage of adequate funding.

Evidence from Professor J H Holloway, Head of the Chemistry Department, University of Leicester

1. BACKGROUND

- (i) My research activity is in the area of Chemistry and my specialist interests are in Inorganic Fluorine Chemistry. I have published around 200 papers, articles and books in this area.
- (ii) My research group has a high reputation internationally.
- (iii) I have never been part of a specific "international scientific programme" but my collaborative work has been supported by agencies such as the SERC and the British Council as well as agencies abroad such as NATO.
- (iv) I have and have had a number of major collaborations with colleagues in Canada, France and Yugoslavia, which have resulted in the publication of more than 10 papers in each case.

2. EVIDENCE ON MATTERS RELEVANT TO THE TERMS OF REFERENCE OF SUB-COMMITTEE II

Answers to Issue:

- (i) My own work abroad has resulted in increased research funding for my work from foreign agencies, input of ideas from collaborators (which would not have taken place without the collaboration) and increased productivity for my group, the University and the funding agency. These experiences, presumably apply also in the case of ISPs.
- (ii) No comment.
- (iii) My experience of ISPs of EC origin is that they have too short a lead time, require too much form filling and appear to be often poorly refereed. Political expediency is also often more important than the science.

Two Letters to the Clerk from Professor C I Howarth, Department of Psychology, University of Nottingham

Dear Sir,

In response to the request for evidence on the participation in International Scientific Programmes, I have some comments based on my experience co-ordinating work in the European Centres as a project leader in two DRIVE projects funded by the European Commission. DRIVE is expected to spend about 200 million ECU over six years in finding ways to use Information Technology to make road transport more efficient, safer and less polluting. Based on this experience my comments are:

- (1) Large international programmes are comparatively inefficient ways of funding good science. I estimate that my projects could have been done at much less than half the cost if funded on a national programme.
- (2) These programmes are inefficient for two reasons.

- (a) The projects are judged on political as well as scientific grounds. It is clearly understood that the funds must be spread fairly evenly among the different countries, even when, on purely scientific grounds, that would not be desirable.
- (b) Co-ordination of the work of partners in different countries is time consuming, especially as the uneven quality of the work requires the stronger of the partners to devote time to correcting and educating the weak.

The extra cost of many international programmes is therefore a consequence of their attempting to achieve political as well as scientific objectives.

It follows that science will suffer if a large amount of the normal science budget is diverted into international programmes.

It should, of course, be possible to fund research from International Scientific Programmes as efficiently as it is funded at present by national programmes, such as our own Research Councils. This could be done if allocation of funds to projects were based solely on the scientific merit of proposals. But that would, almost inevitably, result in funds from poorer countries being diverted to support research in richer countries. Since this would be politically unacceptable, we must accept and adapt to the inefficiencies of international programmes.

The best way to meet both scientific and political objectives would be to ensure that any funds taken from the science budget are matched by additional funds specifically intended to help the International Scientific Programme to achieve its political ends.

Yours sincerely,

Professor C I Howarth

Dear Mr Walters,

Further to my letter of 10 July, thank you for giving me an opportunity to expand on my suggestion that "funds taken from the science budget for international programmes should be matched by additional funds to cover the 'political' element of the expenditure".

I made this suggestion because I am conscious of the extent to which almost all scientific activity is being increasingly affected by practical and political consideration.

The development of international programmes is not the only example of this. The increasing power of the "customers" within government departments which commission research, the setting of priority areas such as AIDS (MRC) and Biotechnology (SERC) by the Research Councils, and investment in microelectronics and information technology via such programmes as Alvey, are further examples of the same process within a national context.

It is entirely appropriate that science should be influenced and used in this way. But, we should learn from our experience how to maximise the combined scientific and political benefits.

It is easy to think of examples from history which show that a science which ignores practical problems can produce new insights of staggering practical importance. For example, when Wilhelm Gauss discovered electromagnetic waves, he was pleased to think that the phenomenon had no conceivable practical use.

It is equally easy to think of examples of money being wasted in attempting a scientific solution of a practical problem before the fundamental science was ready. The disappointing return from President Nixon's investment in cancer research was one example of this. Most scientists are convinced that science has a logic of its own which dictates where effort can be most economically and effectively applied. The application of new insights depends on the quality of these insights and attempts to short circuit the process by premature application are usually very wasteful, even when they are ultimately successful.

When politicians try to influence scientific activity, they naturally press for more rapid applications of science and in doing so run the risk of wasting money by diverting funds from the fundamental scientific goose which lays the golden eggs.

This is not to say that politicians and others with practical problems should always wait until the fundamental scientists tell them the time is right. It is worth spending money to speed the advance of medical science, even at the risk of some inefficiency in the process. Similarly, greater speed but less efficiency is probably desirable in the development of economically important new technologies and in developing international collaboration. There are strong cost-benefit arguments for spending money in this way.

But these cost-benefit interactions would be quite different if, in the process, we were to reduce the amount of activity driven by purely scientific logic. If the effort on pure science is reduced it is impossible to predict what will be lost, just as it is impossible to predict when the practical advantages will be found. All that is certain is that of all investments in the modern world, the investment in pure science has produced the greatest return (although not usually to the original investors).

In Britain we have a lot to learn about the effective application of scientific discoveries. But there are still enormous advantages in being first, for those centres such as the USA, which are better at exploitation than we are. Even the Japanese, the world's most effective exploiters of science, are now realising that they have not invested enough in pure science.

I am sorry to have taken so long to put these ideas in context, but experience with the effects of other political pressures suggests ways in which we should approach international scientific programmes.

You ask particularly for ways of measuring the "opportunity cost" of the "political" aspect of collaboration. There are two aspects to this. The first is the value of the programme in political terms. The second is the loss to pure science which follows from any change in direction under political pressure.

I cannot suggest any way of measuring the political value of a policy. But politicians seem to be able to do it. Provided the policy makers have a clear idea of the additional cost incurred by a programme, there is no alternative to leaving the decisions to them. They may take advice from economists, social scientists, engineers or manufacturers, concerning the likely pay-off at political, social or economic levels. But ultimately the decision is political.

The danger is that policy makers may falsely believe that the cost of a programme is less than it really is, because some of it can be taken from the ordinary science budget.

It would be foolish to claim that none of the cost of an international programme should come from the science budget, since part of the science budget is intended for applied research and, moreover, some of the objectives of both pure and applied research may be achieved more effectively by international collaboration. The difficulty is to ensure that sensible decisions are taken about the balance of costs and benefits for science, in order to tell politicians how much of the science budget it is safe to use for international programmes.

Once the problem is seen in this way, it seems fairly obvious that the only people who can make sensible judgments about the scientific costs and benefits are members of the scientific community. All senior scientists have extensive experience of this kind of decision making, both within their own institutions, and when advising Research Councils and government departments about research expenditure. Moreover, they learn from this experience when, later, they are asked to judge the quality of what has been achieved. It would be wrong to ignore the depth and quality of this expertise.

Hence my suggestion is that all decisions about how much the science budget contributes to international programmes should be taken by those scientists who are responsible for administering the national scientific budget. The Research Councils, or other advisory bodies of scientists, are obvious candidates for this role. It would be a difficult role for them to play, but no other group has the relevant knowledge or experience.

Obviously, there are several ways in which the decisions of the scientists could be transmitted. My own preference would be to ask them for a commitment from their own budget in the form

Y per cent of the total budget up to a maximum of £X.

This would enable them to set an upper limit on the amount which could be risked from the science budget without doing too much damage to other aspects of science and also to estimate the factors by which the scientific efficiency of the programme would be reduced by the necessity for international collaboration. My own experience suggests that Y should be less than 50 per cent, but in other programmes experience may be different. In some exceptional circumstances, international collaboration may be scientifically desirable and so Y could be 100 per cent. For values of less than 100 per cent, the politicians could decide in the usual way, whether the remaining cost of the programme was worth supporting.

The important element in my proposal is that politicians should be prevented from making unrealistic decisions because they underestimate the cost of raiding the science budget.

Yours sincerely,

Professor C I Howarth

Evidence from the Institute of Physics

INTRODUCTORY NOTE

The government provides funds for UK scientists to work in two main kinds of collaborative international scientific research:

- (a) At, or with, access to central institutionalised facilities such as CERN in Europe, SLAC in the USA, and large telescope installations around the world.
- (b) Within initiatives stimulated by European Community "Framework" programmes.

Two kinds of Framework programme concern us:

- (a) Those involving industrial companies in pre-competitive research programmes with EC partners—e.g., ESPRIT, EURAM.
- (b) Collaborations bringing together academic researchers with similar interests from two or more EC countries.

We highlight:

- (i) **The considerable advantages in joining International Scientific Programmes.**
- (ii) **The considerable advantages to be derived from hosting large-scale international facilities.**
- (iii) **The desirability of making government practice and guidelines on ISPs more widely circulated and understood.**
- (iv) **The need to make Treasury financial rules more appropriate to the needs of UK physicists.**

THE INSTITUTES' SUBMISSION

(Roman numerals down the left-hand side of this document refer to questions with those same numbers in the original request for the Institute's Submission).

(i(a)) The advantages of joining International Scientific Programmes.

For large international installations and facilities—of which CERN is a prime example—the most significant advantage is that cost sharing ensures that first-class research, beyond the resources and capabilities of individuals, groups, or even nations can proceed, and proceed effectively. Frontiers of science are pushed forwards through the collaboration between experts of the highest calibre from many countries.

In successful collaborative programmes of all kinds, new ideas are stimulated. This is particularly valuable to young physicists, who can work alongside leaders in the field. In general, those who participate in such programmes feel that scientific progress and technological advances proceed more rapidly, and both scientists and their financiers realise that good value for money can thereby be obtained.

Healthy competition between different scientific groups also advances scientific progress, and such competition enhances scientific programmes, as different groups become aware of each others' activities. Therefore the quality of scientific research is maintained as a consequence of both the co-operative and the competitive aspects of collaborative programmes.

For industries participating in collaborative programmes there is a saving in costs, resulting from pre-competitive exchanges of scientific information, and the sharing of technology. Research aims and objectives are clearly determined through integrated workplans involving optimisation of resources and the generation of necessary technological and manpower expertise. Companies benefit since they only have to meet a part, usually 50 per cent, of the costs. Access to leading-edge science and a stake in ambitious research, with agreement on common specifications, standardisations and measurement standards, can open up markets and increase freedom to trade, while contacts with other companies or other industrial organisations provide immediate potential for developing new markets.

(i(b)) The disadvantages of joining ISPs.

Many industrial companies ignore EC schemes, regarding the excessive paperwork before and during projects, and the additional work in formulation, planning, submission and management of the projects as a waste of valuable manpower and time. The sharing of Intellectual Property Rights and the threat of loss of confidentiality are also deterrents.

Academic researchers share the views of industrialists concerning excessive paperwork and frustrating bureaucracy in some EC programmes. They also regret the reduced flexibility of large Framework programmes, which may have to be scientifically safer and less daring. The time scales become longer, as approval of several countries—for sharing out project work and making provision for research students, for example—is sought.

For academics in teaching, the demands of time-tabling flexibility and time allocation among academic colleagues and technical support staff in home institutions have to be met, even before the problems of being away from home and from their commitments to undergraduate and postgraduate teaching are resolved.

EC scientific programmes are narrowly focussed. There is a danger that scarce funds might be committed to such programmes by the UK government at the expense of broadly-based fundamental research programmes currently, or in future likely to be, supported by UK Research Councils.

(ii) The advantages of hosting large facilities, to the UK, to the funding department and to the participating institution.

The advantages to any host country of setting up a large facility—such as ILL at Grenoble, or the JET project at Culham—far outweigh any disadvantages. Prestige is gained by host-country scientists and the local communities. The inflow of people with considerable purchasing power increases local prosperity. Another benefit is the co-operation and understanding which develops between local communities and the scientists.

The need for housing and supporting infrastructures rises, local employment increases, and locally-based sub-contractors gain a disproportionate share of out-working contracts and service-industry work. Long-term benefits of this kind *must* be borne in mind by planners when the costs of necessary investment in new roadways, schools or communication systems, etc., which are necessary to enable the facility to be brought on site, are being considered.

A disadvantage is that an inflow of wealth may inflate local prices, and morale may be adversely affected when scientists from other countries are paid markedly different salaries, usually in excess of that earned by the local scientist.

(iii) The machinery whereby international programmes are set up and its adequacy in the UK with specific examples where appropriate.

UK government departments provide good information services, and procedures for involvement are regarded as adequate for EC Framework programmes such as ESPRIT and BRITE which are backed by good central management teams at the EC. The support from the DTI is useful in many cases, but some government departments are not as effective as they might be because, often, the administrative response is too slow, caused, in part, by too frequent staff changes. Consequently, relevant practical and financial support is slow in forthcoming.

Activities in central and international facilities under the umbrella of the UK Research Councils are seen by most respondents as effective in initiating and sustaining new programmes. Councils, however, encounter difficulties in coping with proposals for research which crosses boundaries of research areas for which funding is currently provided.

Views of scientists in industry and academe are also given expression through the Royal Society (and the diversity of funding groups to which scientists may appeal for funds is viewed as a positive feature of the present system).

New machinery and finance to allow more short-term and long-term exchange visits by individual scientists would be welcomed. Some respondents, however, believe that informal collaborations are the only satisfactory relationships for the basic research areas.

(iv) The technical and financial criteria under which proposals for ISPs are presented and considered.

There is evidence that there is insufficient awareness of both technical and financial criteria, outside those self-imposed by the scientific community. The Treasury's payment rates, for travel and subsistence, for example, were seen as inhibiting UK participation. There have been times when money set aside is inadequate when the time comes to pay, especially when there have been adverse currency fluctuations.

(v) The forums in which the discussions to participate in ISP's are normally reached.

Approaches for funds from EC Framework programmes are made by inter-national groups after inter-group consultations. For scientific research at extended facilities, recommendations for collaborative studies usually come from the scientific communities themselves or from arms of government advised by scientific experts. The necessary open democratic forums of expert scientists are then set up to discuss proposals and possibilities. Thorough refereeing procedures are established involving people at a high enough level to have wide contacts in their own field throughout and beyond Europe.

Decisions on *funding* are made at government level, however, remote from most scientists.

(vi) Government Practice and Guidelines on ISP's—how they apply and how widely they are known and accepted.

"We know of no guidelines" sums up the views of Institute members, and it is suggested that relevant government departments address this problem at once.

(vii) Treasury rules of additionality and attribution—how they apply in respect of ISP's and the Science Budget and how they treat inflow of foreign money.

See iv; the IOP feels unable to comment on these issues.

(viii) Impediments within the UK to engaging in ISP's, e.g., Treasury rules, relative UK salary scales, housing, travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions.

A problem for UK academics working abroad is their separation from their undergraduate and research students.

The UK rules and government rates for housing and travel are clearly stated and well understood, but there is inflexibility when it comes to foreign currency payments, and this discourages UK scientists. University physicists in the UK do not have the finances available to support the necessary foreign travel, housing and service costs. Furthermore, in relation to most European colleagues, UK scientists have modest salaries.

Foreign currency fluctuations were mentioned by several respondents as significant deterrents to participation in programmes. However, the UK's entry into the ERM of the EMS should moderate any fluctuations in future. For industrialists there was also the problem of shared Intellectual Property Rights.

(ix) Impediments in other countries to their engaging in ISP's

No comment.

HOW THE INSTITUTE'S SUBMISSION WAS FORMULATED

1. The following groups of physicists were asked to provide their considered responses to the questions posed by the House of Lords sub-committee:

- (i) The Standing Conference of Professors of Physics in UK Universities
- (ii) The Heads of Physics Departments in Polytechnics
- (iii) Members of the Council of the Institute of Physics
- (iv) Members of the Institute's Industry Committee

- (v) Physicists in responsible positions in more than 50 industries within the UK
 - (vi) Physicists in industrial companies which are Corporate Affiliates of the Institute of Physics.
- In total 292 requests were sent out.

2. Replies from the 55 respondents were analysed.

3. Summaries of the responses for each question were made and draft Response was prepared by the Institute's Regional and Public Affairs Department. The draft was sent to senior members of the Council of the Institute for their comments, before the final Reponse was submitted.

LIST OF RESPONDENTS

A *From UK Universities (with name of respondents given in parentheses)*

Brunel, Department of Physics (Professor D C Imrie)
 Cambridge, Department of Applied Mathematics and Theoretical Physics (Professor H K Moffat)
 Cambridge, Department of Physics (Professor A Howie)
 Durham, School of Engineering and Applied Science (Professor D Bloor)
 Durham, Department of Physics (Professor A D Martin)
 Glasgow, Department of Physics & Astronomy (Professor R P Ferrier)
 Glasgow, Nuclear Physics Group (Dr R O Owens)
 Glasgow, Experimental Particle Physics Group (Dr R Turnbull)
 Keele, Department of Physics (Professor W Fuller)
 Leicester, Department of Physics (Professor K A Pounds)
 London, King's College, Department of Physics (Professor E R Pike)
 London, RHB New College, Department of Physics (Professor P V March)
 London, University College, Department of Physics and Astronomy (Professor R Wilson)
 London, University College, Elementary Particle Physics Group (Professor F W Bullock and Dr D J Miller)
 London, University College, Ground-Based Astronomy Group (Dr A J Willis)
 London, University College, Space Science Group (Professor J L Culhane)
 London, University College, Atmospheric Physics Group (Dr D Rees)
 London, University College, Positron Physics Group (Dr M Charlton)
 Manchester, Department of Physics (Professor A Donnachie)
 Nottingham, Department of Physics (Professor W F Nash)
 Oxford, Department of Physics, Clarendon Laboratory, (Professor R A Cowley)
 Oxford, Department of Physics (Professor C Llewellyn Smith)
 Salford, Department of Pure & Applied Physics (Professor B Yates)
 Surrey, Department of Physics (Professor D Jackson)
 Sussex, School of Mathematics and Physical Sciences (Professor R J Tayler)
 York, Department of Physics (Professor J A D Matthew)

B *From UK Polytechnics*

Napier Polytechnic of Edinburgh, Department of Applied Chemical and Physical Sciences
 (Dr J Higinbotham)
 Portsmouth Polytechnic, Department of Applied Physics and Physical Electronics (Professor A J Pointon)

C *From Industry and Research Organisations*

AEA Technology (Mr D H Day)
 Allen Clark Research Centre (Dr A J Holden)
 BBC (Engineering) (Dr C P Sandbank)
 British Nuclear Fuels plc (Professor R H Allardice)
 ECC International (Professor B Jennings)
 ICI Explosives (Dr I J Kirby)
 National Physical Laboratory (Dr M E Peover)
 Powergen (Dr A R Jack)
 Rutherford Appleton Laboratory (Dr P R Williams)
 Royal Signals and Radar Research Establishment (Dr S J Robinson)
 Thorn Lighting Limited (Dr F L Whittaker)

D *From individuals*

Dr P E J Flewitt
 Professor E Jakeman
 Mr J L Lewis
 Dr W L S Rae
 Professor G H Stafford
 Dr D W Swift

E Other replies

One organisation (BP) had sent in a submission through other channels and therefore did not wish to comment. Nine other organisations replied that they did not wish to comment at this stage.

Evidence from the Institution of Chemical Engineers

Background

The institution of Chemical Engineers (IChemE) is pleased to be invited to make an input into these discussions.

The IChemE was founded in 1922 and incorporated by Royal Charter in 1957; it currently has approximately 20,000 members in the UK and overseas concerned with chemical and process engineering. It is involved in both undergraduate and postgraduate training; academic and industrial research; and every aspect and area of process engineering.

The Views of the IChemE on ISPs

Members of the Institution were asked to comment on the issues raised by Sub-Committee II. The following consensus was reached: that historically, the Chemical Industry has not tended to be involved in large, centrally-funded international scientific programmes, although large-scale collaboration has always been a feature of the industry on a self-supporting basis. Such projects have relied upon the UK Government to provide not funding but the infrastructure required for the work.

However, the Institution recognises that there are a number of issues, particularly in the areas of the environment, health and safety, and in pre-competitive research where the possibility of ISPs might be considered, and where, indeed, there are opportunities from which the UK might benefit.

As an example, were the UK to host a pan-European Environment programme there would be many advantages, both economic and scientific, to the UK but the Government needs to be pro-active on research and development not to lose such laboratories to overseas. The required infrastructure needs to be in place; there should be a healthy climate for research in Universities, thereby producing sufficient high quality personnel for research activities outside academia; investment in R&D should not be discouraged; there would have to be tax advantages for the companies involved, etc. The Institution feels that this would create a solid home base and that with a successful home market for R&D then the UK would be a credible bidder for international R&D programmes.

Conclusions

Although the Chemical Industry has little experience of Government-funded ISPs its experience in running its own projects of this type have enabled members of the Institution of Chemical Engineers to make suggestion on areas of potential research collaboration that would be of benefit to the UK.

Letter to the Clerk from the Institution of Professionals, Managers and Specialists

I promised your office a note highlighting the Institution's views on the United Kingdom's involvement in international scientific programmes.

The Institution of Professionals, Managers and Specialists (IPMS) is the trade union which represents 90,000 scientific technical and specialist staff in the Civil Service, related public organisations and an increasing number of private sector companies. Over 4,000 of our members work in the Research Councils, 1,200 in the DTI's research laboratories and numerous others in R&D activities within organisations such as UKAEA, BNFL, MOD and MAFF.

In November 1989, the Institution submitted written evidence to the House of Commons Education, Science and Arts Committee's enquiry *Science Policy and the European Dimension*. In compiling this evidence, we drew on the experiences of our members in the Research Councils of participation in projects funded by the European Community and their opinions on how the level and quality of that participation might be improved. I enclose a copy of this evidence for your information. (not printed)

Of course, the Commons Committee's enquiry was specifically concerned with EC research. However, a number of the points we made have wider relevance to UK participation in other international programmes. In particular, I would like to draw your attention to the following:

- (a) That IPMS believes very strongly in the benefits to the UK and to individual scientists of involvement in international scientific programmes (paragraphs 16 to 18).
- (b) That reduced Government support for science during the 1980s has resulted in sub-standard equipment and the loss of qualified staff, making UK public research organisations less attractive as partners in projects (paragraphs 5 to 9). The Committee has already commented on the low pay levels and resultant shortages of public sector scientists in its report on *Civil R&D* (February 1989).
- (c) That the excessive use of short-term appointments for scientific staff results in discontinuity within research teams (paragraph 7). This is, again, something the Committee has already commented on, in its report on *Agriculture and Food Research* (1988).
- (d) That the application by the Government of "attribution" and "non-additionality" acts as a considerable disincentive to involvement in international programmes (paragraph 13). Although these principles do not as yet apply in the Research Councils, they do in the DTI and we share the Lords Select Committee on the European Communities' view—in its report *A Community Framework for R&D* (1990)—that they operate against the national interest.
- (e) That the Government has failed to provide the practical support and advice that scientists need when applying for participation in international programmes (paragraphs 24 to 36).

I hope these points are useful to the Committee. Our members in UKAEA are currently compiling some information on their experiences within the JET programme and Elizabeth Jenkins, our National Officer for the Authority, will write to you shortly with the Institution's views on this specific subject.

Yours sincerely
Steve Jary
Research Officer

Further evidence from IPMS on employment issues, with particular reference to the Joint European Torus (Jet) Project

It should be a basic principle in any joint research project involving more than one country that those working on that project are all treated equally.

This principle was not established when the Commission set up the Joint European Torus (Jet) project at Culham in Oxfordshire. The UK staff are employed by the United Kingdom Atomic Energy Authority (UKAEA), and seconded to JET. Their terms and conditions remain those of the UKAEA, and are therefore in many areas less favourable than those enjoyed by staff from other member states doing identical jobs. In addition, they are prevented by the statutes governing JET from applying for other comparable posts in other Commission research projects.

This is the only site in Europe where such discrimination exists. At other joint research projects—such as those at MSU, Geel, Petten, Ispra and Karlsruhe—the Commission employs all nationalities on the same terms and conditions. It has been a continuing source of discontent. It is in our view greatly to the credit of the UK staff involved that this inequality has not prevented proper co-operation throughout the project between staff from the different member states involved.

It should be noted that in 1987 the European court of Justice recognised the discrimination at JET and also judged certain employment practices at JET to be unlawful, but as yet, they remain unchanged. Indeed to circumvent the effect of the European Courts judgment, new discriminatory employment practices were introduced. Nevertheless the 1990 report of the Fusion Programme Evaluation Board acknowledged that future projects should be staffed on an equal basis following the unhappy experience at JET.

Recently the UK Government has expressed concern that UK nationals are under-represented in Commission posts but the unlawful employment practices at JET still prevent UK nationals from applying to the Commission on an equal basis. In private correspondence, the Cabinet Office, through the Right Hon. David Mellor has said that the matter is not for the Minister of State but remains the responsibility of the UKAEA. However, John Collier, while Chairman of the UKAEA confirmed in writing that the UKAEA would not longer oppose a change of employer for UK staff, in fact he added that he "would never have opposed it".

It would appear therefore that the responsibility and ability to offer equal opportunities to UK nationals, in line with other European nationalities, rests with the Commissioner himself.

Nevertheless it is in our view a matter which the Sub-Committee needs to address, both in terms of the general principle involved and in its practical implications for the United Kingdom.

Letter to the Clerk from the Secretary General of the International Council of Scientific Unions

Dear Mr Walters,

I am pleased to respond to your letter of 8 June on International Scientific Programmes. Given ICSU's particular role as the international non-governmental organisation for scientific co-operation, we feel competent in responding only to two or your questions:

(i) The advantages and disadvantages in joining ISPS to the UK; etc:

The International Council of Scientific Unions, since its establishment in 1931, has counted on the deep involvement of the UK scientific community in all of its activities, through its National Member, the Royal Society. Since 1931 we have had four UK scientists as President and four as Secretary General, not to mention the numerous other UK scientists who have held important offices on our Executive Board and on our various Scientific Unions and interdisciplinary committees. ICSU has certainly benefitted from this participation and I believe that the UK scientific community has in turn profited from this close involvement in international scientific programmes either in a single discipline, or in interdisciplinary activities. As far as ICSU is concerned therefore, there can only be advantages for the increased participation of UK scientists in our international programmes, particularly in view of the increasingly global nature of our concerns, as demonstrated by the global research programmes on the environment and global change. A continuous impediment in launching and implementing international programmes is the lack of funding for these in relation to the scale of national funding given to programmes carried out at the national level. More attention paid to this would greatly help our efforts and would therefore enhance the effectiveness of international programmes.

(iii) The machinery whereby international programmes are set up and its adequacy in the UK:

International programmes are set up either by one of the organisations of the UN alone, by an international NGO, such as ICSU, or in co-operation between them. Examples of these which have concerned our own organisation include the International Biological Programme, which started off as an ICSU-sponsored activity and which, upon its conclusion, became a Unesco programme; the World Climate Research Programme, which is jointly sponsored by ICSU and the WMO, and the International Geosphere-Biosphere Programme, which is solely an ICSU activity. All of these require a sustained support from national funding bodies in close concert with the appropriate national scientific group. Our experience shows that in those countries which have a separate governmental department for science, communication is facilitated, and in those countries where several government bodies deal with science issues the response rate is considerably slowed down. We have tried to help overcome this difficulty by inviting our National Members (Royal Society in the UK) to include in their delegation to the meeting of the forthcoming Scientific Advisory Council of the International Geosphere-Biosphere Programme, representatives of the appropriate governmental agency. We hope that this approach will help overcome this particular problem.

Yours sincerely,

J W M la Rivière

Secretary General

Letter to the Clerk from the Secretary-General of the International Maritime Organization

Dear Mr Walters

SUB-COMMITTEE II—INTERNATIONAL SCIENTIFIC PROGRAMMES

Thank you for your letter of 18 June inviting evidence to be submitted by the International Maritime Organization on matters relevant to its terms of reference on issues to be investigated by the Sub-Committee II of the House of Lords Select Committee on Science and Technology.

I wish to thank you and the Sub-Committee for the opportunity afforded to this Organisation to provide evidence on these important issues.

However this Organisation does not itself conduct research but draws upon and to the extent appropriate co-ordinates technological research carried out by or on behalf of its Member Governments and by non-governmental organisations which have been accorded consultative status with IMO. In the main the type of research which is relevant to IMO's mandate is adequately served through this means. However, two matters currently faced under IMO's work programme, viz. the substitution of CFC's and Halons on board ships to meet time scales established under the 1987 Montreal Protocol, and scientific technological studies related to the possible phasing out of incineration at sea by 1992 under the London Dumping Convention, would benefit very much from international action.

Your sincerely,

W A O'Neil,

Secretary-General

Evidence from Sir John Kendrew

The issues raised by the Sub-Committee cover a very wide range and within a brief compass I believe all I can do is to make a few very limited comments on particular points.

2. The advantages of joining such programmes are of course obvious if large machines, too expensive for any one country, are involved (e.g., CERN, ESRF). If not it is difficult for enthusiasts to persuade their colleagues, let alone Governments, of other advantages of joining especially in times of financial stringency, when scientists see their own budgets threatened by compulsory subscriptions to international organisations. These organisations may however contribute, not only to science, but to international relations in general, so it should be remembered that the likely benefits are often political as well as scientific, and this may be a reason for questioning whether the whole cost of international subscriptions should always be borne by the Science Budget.

3. In the case of the UK a major problem has been the discrepancy between academic salaries here and in most Western European countries. In the early '70s the DES contemplated proposing a British location (at Culham) for the EMBL which eventually went to Heidelberg. The proposal was never formally made owing to difficulties with the Treasury over tax-free salaries, and with the Trades Unions over salary levels in general. Similar difficulties have caused much trouble in practice in JET.

4. A major problem with most international organisations has been creeping bureaucratisation. The founding fathers generally attempt to make the administration simple and flexible; at first they succeed, but with time the organisation becomes increasingly bound by bureaucratic restrictions often more complex than those of comparable national organisations; and this by degrees makes the organisation less efficient and less idealistic, and therefore less attractive both to sponsoring governments and to talented scientists.

I believe there are two main reasons. First, it is in practice extremely difficult to recruit really good candidates for senior administrative positions in international organisations; they must generally be extracted on secondment from their national organisations, and they fear—generally with good justification—that their promotion prospects at home will be adversely affected (I have personal experience of several examples where either the fear has inhibited good candidates from coming forward, or else the reality has been only too painfully experienced by seconded administrators on their return home). Less competent administrators are more likely to be “bureaucratic” in the bad sense of the term.

Second, the governing councils of international organisations consist of delegates of the member states. At the beginning the organisation has some political importance and states send rather senior delegates; as it becomes established, the level of the delegates goes down. At these lower levels one is more likely to encounter pressure for unnecessarily bureaucratic practices, especially because the bureaucrats of one country tend to be suspicious of the practices of the others and are therefore determined to leave nothing to chance by tying the organisation up in an unnecessary amount of bureaucratic string.

Research organisations subsidiary to non-scientific intergovernmental organisations are particularly susceptible to these difficulties, because the IGOs themselves are often highly bureaucratised and their regulations are transferred automatically but inappropriately to the research organisation stemming from them. Examples are UN bodies (e.g., the International Centre for Genetics and Biotechnology (ICGEB) at Trieste and new Delhi, dependent on UNIDO), and regional IGOs like the European Communities (e.g., the Joint Research Centre at Ispra and elsewhere).

It seems to be that these problems merit study because over-bureaucratisation is a common, and often justified, complaint against international scientific organisations.

5. I do not know enough in detail about Treasury/Cabinet Office guidelines, or about Treasury rules of “additionality”, to be able to make useful comments.

6. It should be remembered that many of the most successful international scientific programmes are non-governmental, e.g., the twenty Scientific Unions, the financial support of which is only indirectly governmental (subscriptions paid by National Academies, and subventions from UNESCO, UNDP and other UN bodies).

John Kendrew

9 August 1990

Evidence from Dr M A Khan, Head of Geology Department, University of Leicester

My comments on the issues specified in the Select Committee's letter of Friday 8 June to Sir Edward Parkes are as follows:

1. The main advantages of participating in such programmes is that the individuals can get involved in exciting experiments in which they could not be involved otherwise. International experiments are usually

those which are beyond the means of a single country. Working closely in the field with other experts is the best way of exchanging ideas. It ensures that one keeps up with the state of the art. This is of particular benefit to graduate students some of whom will become the academic leaders of the future. The principal disadvantages in my experience is the difficulty of participating on equal terms. Obtaining funding for RA's or graduate students to work on data from international projects is particularly difficult. We therefore lose out on publication and consequently kudos.

2. We have no experience of hosting large facilities which are used by international colleagues. But I have no doubt that it would be a tremendous advantage to do so. It enhances ones standing and this is clearly advantageous in international competition for grants.

3. I have referred to KRISP above as an example of the international programme machinery. There is no machinery. I discovered there is an NSF-NERC agreement on paper but it meant nothing. There was no money allocated to it in the UK. The Americans had.

4. I don't know what the financial and technical criteria for setting up ISP's are. I suspect big names and loud voices are important criteria.

5. I believe the ODP forum works quite well.

6-9 have not affected our activities.

I hope these remarks will help you to frame a reply.

Evidence from Sir John Kingman, Vice-Chancellor, University of Bristol

THE EUROPEAN COMMISSION'S MODEL CONTRACT

The EC Model contract allows universities to choose one of two funding methods for their contracts. Some directorates allow the choice to be made on a contract by contract basis, others insist on one method for all their contracts.

The choices are:

- (a) 50 per cent Full Economic Cost.
- (b) Marginal Cost.

50 per cent Full Economic Cost

The EC pays half the total cost of the project which includes an overhead rate which must be agreed with the EC. They will accept a rate used for contracts with National Governments.

Marginal Cost

The EC pays all the marginal costs of the project plus an overhead of only 20 per cent (as stated in Graham Blythe's letter to you of 16 July 1990).

The key factors that influence which method is most profitable are:

- (i) The time devoted to the contract by existing University staff which can be charged in (a) but not in (b).
- (ii) The value of equipment required and the length of the contract. The EC only pay one-fifth of the cost for each year of the contract. A short contract requiring expensive equipment needs considerable subsidy from limited University resources.
- (iii) The overhead rate accepted by the EC.

The example given on the following page (2) is illustrative rather than actual so as to highlight the problem areas, all of which can be supported by occurrences in individual contracts, but that would require extensive explanations.

The example illustrates:

- (i) The time devoted by existing members of staff is eligible for overhead under 50 per cent FEC, so contributes greatly to the proportion of the total cost funded by EC if this method is adopted.
- (ii) An expensive piece of equipment can be very difficult to fund if the EC only offers a short contract that is subject to annual reviews.
- (iii) The overhead rate is critical in 50 per cent FEC funded contracts. The example shows 170 per cent mark up on salaries. Industry would use c.300 per cent. Government departments pay only 40 per cent or less. (MOD are now allowing higher rates if universities can justify them).

Example of EC Contract of Two Years Duration

	Total Costs £	Marginal Costs £	EC Contribution 50 per cent FEC £	Marginal £
(a) National salary of existing lecturer, devoting 20 per cent of time to project	12,200	—	12,200	
(b) Salary of research assistant, employed wholly and specifically on the project	41,200	41,200	41,200	41,200
(c) Consumables	10,000	10,000	10,000	10,000
(d) Travel	3,000	3,000	3,000	3,000
(e) Equipment (actual cost new equipment)	50,000	50,000	—	—
VAT on equipment	7,500	7,500	—	—
2/5 payable by EC included VAT	—	—	23,000	23,000
Use of University equipment	1,000	?	1,000	1,000
(f) Overheads 170 per cent (a + b)	90,800	70,000	90,800	—
20 per cent (a to c)	—	—	—	15,650
Total	215,700	181,700	181,200	93,850
True Cost	215,700	215,700	—	—
EC Contribution	—	—	90,600	93,850

No allowance included for inflation

In order to recover the full cost of a project, the University needs to justify an overhead rate of 170 per cent or more, but EC regulations make this difficult. The model contract states that “overheads may be charged only in accordance with such conventions, policies and principles accepted by the Commission”. These conventions expect universities to isolate and identify research costs, as distinct from teaching and other costs. We gather that no UK University has succeeded in doing this and those that have tried have had to revert to the marginal cost method.

At a recent Bristol seminar we were informed that consideration was being given by the EC to see if a composite UK University overhead rate could be agreed. This would be advantageous if the composite rate was high enough to enable all universities to cover all their costs.

Another area of particular concern is how building costs are allowed for in the calculations. Universities can only include buildings at their historical cost. This does not reflect current values or opportunity cost. (Use of insurance valuations would be an acceptable compromise).

Universities are keen to involve themselves with EC projects, but clearly require extra resources if they are to join all the projects which would be of interest.

INFLATION AND EXCHANGE RATE FLUCTUATIONS

When estimating costs for an EC fixed price contract, those costs affected by inflation, exchange rate fluctuations, or pay awards have to be estimated over the whole duration of the project. Once awarded, the total price of an EC contract cannot be exceeded. This is not the case with Research Council contracts, where estimates are readjusted annually to take account of these factors.

On a positive note, working in ECUs, as opposed to national currencies, helps to avoid some of the problems associated with exchange rate fluctuations.

VALUE ADDED TAX

The procedures for recovery of VAT are very cumbersome. Copies of all VAT invoices must be sent to the European Commission in Brussels who then refund the VAT to the University. The Commission then claim the VAT from the UK Treasury. This is a UK Treasury, not an EC ruling.

BUREAUCRATIC DIFFICULTIES

My letter of 16 July 1990, mentioned that the administration of EC contracts was more time-consuming than for Research Council contracts. This is true, partly because universities are still at a comparatively early stage of dealing with EC Research contracts, and partly because the monitoring and information requirements are greater for the European Commission.

However, the model contract has improved matters, and the European Commission takes great pains to supply help and advise at every stage (as Graham Blythe points out in his letter of 16 July 1990, on page 2 (C)).

It should also be noted that the non-financial benefits of entering into EC Research contracts are of value in themselves and form part of the University's strategy with regard to Europe.

CONCLUSION

The University would request the Select Committee on Science and Technology to put pressure on the European Commission to:

- (a) Clarify the position over the calculation of overheads, with special regard to establishing a composite rate.
- (b) Fund equipment in full.
- (c) Fully fund the negotiation costs for successful contracts.
- (d) allow estimated costs to be readjusted in the light of inflation, pay awards or exchange rate fluctuations.

As (b), (c) and (d) are unlikely to be agreed by the Commission, the Select Committee should recommend that the UK Government supplement EC grants to universities, so as to encourage them to take part in projects which are of interest, without suffering substantial loss of resources as a result.

The University would also request the Select Committee to ask the Treasury to allow VAT incurred on EC research to be reclaimed as input VAT on normal quarterly returns to HM Customs and Excise, so as to save much duplication of effort by the researcher, the EC and the Treasury.

Evidence from Professor Simon Lavington, Department of Computer Science, University of Essex

INFORMATION TECHNOLOGY: THE ESPRIT PROGRAMME

The following comments relate to ESPRIT, the EEC's programme of near-market research in Information Technology.

(1) The importance of intellectual property.

If the UK input to an international collaborative project is strong, as for example in the ESPRIT projects SUPERNODE (1085) and EDS (2025), then the UK is able to influence or even dominate the conduct of the project and the shape of the resulting market product. The strength of UK input to a project depends critically on the relevant prior Intellectual Property that the UK teams(s) can offer. In the fast-moving world of Information Technology, the possession of up-to-date know-how is initially more important than raw manufacturing muscle.

(2) Role of the larger companies.

In ISPs such as ESPRIT, where both industry and academia may take part, it is industry which rightly takes the lead in bringing together and managing successful consortia. A dozen large European companies have dominated the scene, both at the initial planning stage when the ESPRIT Workplans were being drawn up and later when the bidding for funds was taking place. The large companies include AEG, BT, Bull, GEC, ICL/STC, Nixdorf, Olivetti, Philips, Plessey, SGS-Thomson, Siemens and Thomson-CSF. It is essential for the major UK IT companies to participate vigorously in the politics surrounding ESPRIT. Equally, it is a waste of time for UK academic institutions to enter the international political arena on their own.

(3) Strategy for success.

It follows from (1) and (2) that the strategy for extracting maximum UK benefit from an ISP such as ESPRIT is as follows: (a) maintain a high-quality UK research base in IT; (b) feed this through as IPR to the major UK IT companies; (c) encourage these companies to co-ordinate and lead UK consortia into international collaborations.

(4) Some problems.

There is, inevitably, a long lead-time in pulling research. For example, the research results on CSP, synchronising circuits, and parallel declarative systems that underpin the SUPERNODE and EDS project were published by academics at Oxford, Manchester, Imperial College and the University of East Anglia during the period 1976-86. At the time, such research was mainly "blue skies", funded by SERC. However, since 1989 IT research funding to HEIs has, under the influence of the DTI, largely been directed away from "blue skies" and towards applications-oriented initiatives. It also has to be said that the larger UK IT suppliers feel so constrained by their existing product bases that they are unresponsive to "blue skies" ideas. Time and again it has been the smaller firms and the IT users who have wanted to respond to the potentials offered by University ideas. In the case of small IT firms, lack of resource coupled with the inflexibility of DTI's LINK rules has made progress difficult. Nevertheless, the smaller companies and the IT users have acted as goads to the larger companies. This is especially true in the field of parallel computing.

(5) Recommended actions.

Two actions can be taken to support the strategy outlined in (3) above. Firstly, SERC base-line funding for IT research should be increased. At present peer-review committees, such as that for Parallel and Novel Architectures, are able to fund such a small percentage of submitted research proposals that the whole academic grant system is in disrepute. Secondly, the DTI (through the Joint Framework for Information Technology) should make it much easier for small companies to become partners in HEI/Industry collaborative research projects—for example by relaxing the LINK funding rules. If the UK has a vigorous

programme of R&D at the small high-tech company level, this is a very cost-effective way of pulling through academic research, keeping the large IT companies on their toes, and enabling stronger UK participation in international IT programmes.

Professor Simon Lavington
Department of Computer Science
University of Essex
July 1990

**Letter to the Clerk from Professor C H Llewellyn Smith, FRS, Department of Physics,
University of Oxford**

I can only comment on most of the issues in very general terms. It seems to me that there are some obvious advantages (cost sharing of large and expensive facilities, stimulus from—and access to—new ideas) and disadvantages (increased financial costs, potential problems with intellectual property rights and in some cases with security, and possible problems of communication due to cultural and language difficulties—although I am not aware of any in practice) in international scientific collaboration. The problem is quantifying and balancing these factors.

One problem with some formal international collaborations is that they are funded for rigidly fixed periods, whereas scientific research programmes generally do not have neat, tidy ends: rolling programmes might be preferable, although perhaps too hard to stop. Another potential problem is that Euro-enthusiasm may lead to an imbalance, so that mediocre collaborative projects become easier to fund than outstanding non-collaborative projects, but we do not have the evidence to know whether this point has been reached. There is also a general concern that political factors may result in research money being distributed and spent in ways which are not optimal from a scientific point of view.

The advantages and disadvantages of hosting large facilities are also rather obvious. On the scientific side, proximity is an obvious advantage. There is also an advantageous element of prestige attached to hosting large facilities. Financially there is an advantage to the host state (unless the organisation operates a system of *juste retour*—which must lead to higher costs) because it will obtain a disproportionate share of high-tech orders, and money paid into the organisation by foreign members will flow into the local economy when salaries are spent. In some organisations (e.g., CERN) these advantages are enormous. In others they are offset by a “host state premium”. In general, however, the advantages substantially outweigh the disadvantages and my own feeling is that the UK has not taken a sufficiently positive attitude to attracting international scientific institutes and facilities (this may be a reaction to the danger alluded to at the end of the previous paragraph and what the Prime Minister describes as “diplomatic science”).

I can only comment on a few of the specific issues that are raised. The Government guidelines for future international collaborations, produced by the Cabinet Office, strike me as being quite reasonable although I have not studied them closely. I expect that they are not well known at all. Indeed I have them in an annex to a document marked “Restricted” which is covered by the Official Secrets Act!

There is no question that in the case of CERN the Treasury’s refusal up to now to provide a buffer against currency fluctuations has had a disastrous effect on SERC which is expected to meet a subscription that has fluctuated by up to £8 million from one year to the next from a fixed budget. This has had an adverse effect on scientific programmes with no connection with CERN whose budgets have, quite unreasonably, been threatened by adverse fluctuations, and as a secondary effect this has created divisions in the scientific community. It is clear (a) that the method of calculating contributions to international organisations should be designed to minimise fluctuations (CERN has now adopted a scheme devised by me which is relatively stable, and has saved the UK tax payer about £7 million p.a.), and (b) that the Treasury should be pressed to protect research councils against “non-scientific volume changes” in subscriptions due to currency fluctuations, and also, if possible, against increases caused by changes in the scientific programme which the UK has opposed.

Generalising the last point, I am concerned that the UK may be adopting a (seemingly very logical) position of fixing the total amount of UK tax payers’ money, channelled through all sources (UK funding agencies and EEC), that should go into a given area. This would have the disastrous effect that decisions taken in Brussels in which UK Research Councils have no say could result in their budgets being cut, even if the money is spent in ways which do not fit their strategic plans. This should be resisted at all costs (although no doubt the distribution of money in Brussels should influence the distribution in London, and vice versa, in a general way in the long term). Indeed, I would argue that, far from being illogical, it is highly desirable to maintain a multiplicity of independent sources of funding allocated by responsible bodies according to their own criteria.

The difference between UK salaries and those paid to scientists employed by international organisations has been the subject of considerable adverse comment, but this is perhaps no bad thing as it draws attention to the under-payment of academics in the UK relative to much of the rest of Europe. The important thing

is that salaries for scientists employed at international organisations should be set relative to those of scientists employed doing similar work in the major contributing countries, not relative to salaries paid at non-scientific international organisations.

I am afraid that most of these comments are rather obvious and may not be worth passing on as they will no doubt have occurred to the Select Committee by now.

Yours sincerely,
C H Llewellyn Smith

**Letter to the Clerk from Dr A R Lord, Acting Head of Department,
Department of Geological Sciences, University College London**

Dear Sir,

INTERNATIONAL SCIENTIFIC PROGRAMMES

This department is actively involved with International Scientific Programmes at two levels:

- (a) Formally defined international projects, and (b) less formal collaborative arrangements.
 - (a) — Ocean Drilling Program (ODP) (international consortium with National Science Foundation—UK sponsor NERC).
 - European Community twinning grant (with Institut de Physique de Globe, Paris).
- (b) — University of London SE Asia Consortium links/collaboration with governmental and industrial organisations in Indonesia (including ODA and British Council involvement).

A number of our staff are involved as individuals with projects such as the International Geological Correlation Programme (IGCP—sponsored by UNESCO) or serve as officers/members of international committees and working groups.

We regard participation in international programmes as *beneficial at all levels*. The disadvantages are mainly in terms of time and effort involved in (a) applications for funding travel, laboratory equipment, assistants and research students, etc., and (b) maintaining liaison between different institutions in different countries.

**Evidence from Professor Alan Maynard, Centre for Health Economics, University of York,
consisting of the Executive Summary of the Final Report of the Evaluation of The 4th MHR Programme**

The Panel appointed by the European Commission to evaluate both the scientific achievements and the administrative practices of the Fourth Medical and Health Research Programme. It carried out its task in the period from February to May 1990. In addition to the brevity of the time allowed for this study, other limitations were placed on the review process. The most important of these have derived from the relative immaturity of the Programme and the inadequacy of the data necessary to assess fully the scientific quality and achievements of this major research undertaking. As a consequence the Panel's conclusions are derived from a blending of qualitative and quantitative evidence. They are based on extensive interactions with participants in all of the 12 Member States, and representing all parts of the Programme, as well as two studies made by contractors.

The Panel believes that the steps taken in the past decade by the Commission to bring together the diverse scientific and technological resources of the Community are vital to enhance the future intellectual contributions, productivity, and the quality of life of citizens throughout Europe. No area of science is more intimately related to direct human need than biomedical and health research. Worldwide, this activity is today subject to accelerated change in predictable directions. Increasingly, a relative few among the more than 400 universities and colleges in Europe will emerge as the dominant centres of research and training of scientists and health care professionals.

The number of hospitals capable of specialising in tertiary care will decrease and those remaining will have to provide specialised services to broader areas of the population. The demand for standardisation of health care practices will rise continuously as will the necessity for technological choices to meet inevitably increasing costs and limited budgets. The . . . of information on infectious diseases, epidemiological data essential to improve prevention of chronic illnesses, and clinical trials of new forms of health care can no longer be contained within borders that are legislated to disappear.

It is therefore also predictable that there will be a continuing thrust for greater integration of the underlying scientific research in Europe. The manner in which this will be achieved through a balancing of the contributions and responsibilities between the Community and its Member States will be of the utmost importance in the ultimate elimination of a fragmented approach to meeting community needs while

retaining diversity and cultural differences on which high value is also placed by the population. The reduction of this fragmentation may lead to a more rapid expansion of European funding of medical and health research.

The Panel is impressed by progress that has been made in the new “collegial networks” of research workers across Europe, in the initiation of some Community data bases and in the opportunities for short-term training. Definitive data on the outcomes of the MHR4 Programme are not yet available, but many of the participants have indicated that the creation of networks is a very limited objective. The Panel, in interpreting the Council decision of 1987 which laid out the objectives of the Programme, has assumed that increased collaboration was a means, rather than the ultimate goal, of the MHR4. The Community now plans to increase substantially the expenditures for this Programme and it would seem appropriate and timely for the European community to clarify its objectives beyond the present dominance of “concerted actions” that seem mainly to facilitate more meetings amongst European scientists. Furthermore there is evidence that more of the most productive and creative scientists in Europe must be attracted to participate in, and to be among the project leaders if this Programme of it is to achieve its objectives.

It is also the Panel’s opinion that current administrative practices require improvement if the promise of a more scientifically successful and a healthier Europe is not to be delayed.

The processes for informing the scientific community of what the Programme is, for soliciting and reviewing applications from the best scientists, for selecting priorities and best quality of proposals, for evaluating the performance, renewal and termination of projects, for developing and clearing contracts for accepted proposals, and for the provision of reimbursement, are all below the standard which is acceptable and necessary to operate a large, integrated high quality research programme. It is clear that the Programme is improving and that liaison, personnel and processes are getting better. There are changes, however, that still need to be implemented if the planned expansion of the Programme is not to exceed the capacity of the management to use resources efficiently.

The Panel members recognise the considerable opportunities and the needs inherent in biomedical and health research in Europe. They accept that an impressive start has been made in the Fourth Programme, but they do not consider it adequate for what it will surely be asked to do for the people of Europe.

To enhance the development of medical and health research in Europe the Panel makes the following recommendations:

1. With regard to scientific content, the Panel recommends:
 - (i) That the Community clearly defines the goals of the programme. These political decisions should be compatible with the best scientific evidence.
 - (ii) The funding of the basic biomedical and pre-normative research that facilitates the creation of new and better health care technologies.
 - (iii) The financing of research which develops multi-centre studies with common protocols and/or data bases, with special emphasis on the determination of the cost effectiveness of prevention, treatment and rehabilitation programmes.
 - (iv) The creation of broadly distributed European Centres of Excellence on the basis of competitive, rolling contracts, with no field restriction, and with an obligation to facilitate training.
 - (v) The financing of both post-doctoral (with no field restrictions) and pre-doctoral (to assist developing areas) fellowships, with grants to support the reintegration of recipients into national research communities; special incentives to distinguished scientists to spend sabbatical time in States in special need of development.
 - (vi) That the activities be financed by the reduction of funding of concerted actions, which are no longer the appropriate primary vehicle for MHR in Europe, and by enhanced national contributions to the funding of European research.
2. With regard to research management, the Panel recommends:
 - (i) That steps be taken without delay to move toward the provision of rigorous peer review by international panels of scientists of all applications for funding and evaluation of projects terminating and/or seeking renewal.
 - (ii) That more efficient arrangements be made for collection, updating and retrieval of all the data on projects and other information necessary for Programme management and co-ordination; and at the same time, for timely dissemination of calendars, decision dates and other “rules of the game” to the scientific community throughout Europe. This is only possible if the management function in the Commission is staffed adequately with suitably trained personnel.

Evidence from Professor A Miller, Professor of Biochemistry, Edinburgh University; on leave 1989-91 as Director of Research, European Synchrotron Radiation Facility, Grenoble, France

1. My experience of International Scientific Programmes (ISPs) has been
 - (a) As founding Director of the European Molecular Biology Laboratory Outstation at Grenoble, 1975-80;

- (b) As a member of the Scientific Council of the Institut Laue-Langevin, Grenoble from 1980-84;
- (c) As Director of Research, European Synchrotron Radiation Facility, 1984-89 (part-time) and 1989-91 (full-time).

2. *The Advantages of joining International Scientific Programmes*

- (i) Certain kinds of science are particularly expensive in resources and expertise. It is obviously an advantage to share these expenses.
- (ii) Some "big science" projects are very specialised, e.g., ESA in astronomy, or CERN in particle physics. They serve a rather specialised community of scientists and their research is esoteric. Laboratories such as the Institut Laue-Langevin or ESRF are different. Not only are they much cheaper than ESA and CERN, but by acting as bright sources of neutrons and X-rays respectively, they serve a very large community of researchers and most work done is on "condensed matter", i.e., the everyday materials of solids, liquids and gases that make up our physical and biological worlds.

Condensed matter science has a very wide range and encompasses physics, chemistry, geology, materials engineering, biology and medicine. At facilities such as ILL and ESRF this strong multidisciplinary factor leads to unexpected fruitful interactions between different kinds of scientists, and this benefit is enhanced by the international aspect which brings a larger flow-through of scientists with highly varied research programs.

3. *Disadvantages of joining ISPs*

- (i) Travel can be wastefully time consuming. This is not always true since it is often as easy to travel to European locations as to UK locations from points in the UK. The unfortunate level of European airfares (cf. those in USA) is a disadvantage.
- (ii) The travel to ISPs is not just a financial disadvantage. Most ISPs are used by British academics who have busy teaching and administrative duties at their universities. Fitting in visits to ISPs can be awkward especially since, due to technical problems at the ISPs, beam-time can be rescheduled at fairly short notice and thus upset complex arrangements with teaching colleagues.
- (iii) ISPs put a much larger bureaucratic load on participating countries. This is particularly obvious in certain EEC projects, but no ISP is devoid of substantial bureaucracy which demands not only effort and time but considerable diplomatic skill if the value of the ISP is to be realized.
- (iv) Scientists in the UK whose research does not require ISPs obviously see them as a drain on the science budget since they are often in straight competition for funds with their own projects.
- (v) Technically, the ISPs may make certain kinds of scientific experiments more difficult if the specimens involved are delicate, difficult to prepare, short-lived or hazardous. User support laboratories at the ISPs can help with these problems.
- (vi) A disadvantage to the funding departments is that commitments to ISPs are usually in foreign currency. Currency fluctuations can substantially perturb national science budgets. The ecu could help here.
- (vii) In principle, commitment to ISPs could bring a certain degree of inflexibility to participating institutes, especially if the interests of the institutes changed. In practice, agreements are made for sufficiently short periods that this is not a problem.

4. *Advantages of Hosting an ISP*

- (i) Though a host country may pay a "host premium" (around 10 per cent), it can still be a financial advantage to act as host. In the case of ESRF and ILL, all staff pay income tax on their salaries to the host nation. There are many contracts for work which are only appropriately given to the host nation. Furthermore, there is a general difficulty of enticing so-called "non-cadre" or technician personnel to work abroad. Hence the fraction of technician staff from the host nation is usually well above "*juste retour*".
- (ii) The main advantage of hosting an ISP accrues to the scientists of the host nation. The easy access brings benefits to the scientists even if the scientific proposals are peer-reviewed by international panels. This could be true particularly for ESRF where only 30 Beamlines are funded by the initial agreement setting up the laboratory. At least 60 (possibly 100) Beamlines could in fact be operated at ESRF. Beamlines additional to the 30 funded lines are being proposed by so-called Collaborating Research Groups (CRGs). Already the host nation has proposed twice as many CRGs as other countries and this is to be expected.
- (iii) An ISP can bring social and cultural enrichment to the host nation.

5. *Disadvantages of Hosting ISPs*

It is a considerable responsibility to welcome an international community and to enable foreigners to settle, often for fixed terms, and to work productively in the host country. Some host countries find it difficult to implement agreements on education, and there is no doubt that many find it difficult to enable foreigners to feel welcome. Some nationals in the host country may even resent the foreign intrusion and the disruption and competition as they see it, imposed on them and their families. The social and cultural enrichment I referred to as an advantage can be double-edged.

6. *The Machinery whereby ISPs are set up*

- (i) In general this machinery in the UK is entirely adequate though some critical comments can be made.

Mostly the finance for ISPs comes from the science budget of the Department of Education and Science. Mostly a specific ISP will be the financial responsibility of a specific research council, usually the SERC.

The decision making on ISPs is at two levels which I will call technical and political. The technical decision usually comes first. A group of scientists with an interest in an ISP will convene working parties and report to a research council with a proposal for the UK to join an ISP. This part of the machinery allows wide peer review, critical comments from non-participating scientists, competition with other proposals, etc. In the UK the scientific community has a large say in how the science budget is spent and though they may question the overall size of that budget, I believe that there is general contentment with the mechanism for dividing up the science budget. Obviously pressure groups exist with the usual scope for individuals or groups to deploy their lobbying skills. Once the scientists have agreed that they want to allocate part of the science budget to an ISP the matter then passes to the civil servants to implement this and to draw up the terms of the international agreement which the appropriate UK government ministries will sign. Again, I feel this is done competently. In the Council or governing body of the ISP, the UK is usually represented by civil servants.

- (ii) It is the interaction between what I have called the technical and the political levels at which I would direct some critical comments. These are based on my experience as the UK member on the Directorate of ESRF. During my four years at ESRF I have scarcely had any contact from the UK delegation on ESRF Council. The contacts I have had have almost always been initiated by me. Of course one way of looking at it is that I was appointed to do a job and left to get on with it untrammelled. I warmly appreciate this and contrast it most favourably with some of my colleagues on the Directorate who are vigorously badgered by their national representatives on Council. However I feel the UK goes too much in the other direction. I have, of course, set up working contacts with all the UK scientists whom I regard as appropriate advisors, important potential users of ESRF or potential contractors. However the UK has a substantial commitment to its own synchrotron at Daresbury and despite repeated requests since I joined ESRF, there is no formal contact with Daresbury, such as membership of the UK Synchrotron committee or automatic invitation to the Annual Synchrotron Users Meeting. This is in marked contrast with all my colleagues on the ESRF directorate who are all closely connected to their national programs. I repeat that I have excellent personal contacts throughout the UK and do not think there are important contacts which I am missing, but I have no formal links with the UK bodies which decide on internal allocations of resources for synchrotron radiation, and I feel that this is to the disadvantage of the UK in that concerted, well organised planning and co-ordination of national and international effort is just not done as well as it could be. Other countries do it much to their advantage. I can expand specifically on this if necessary.

I also think that a briefing or planning meeting with UK Council members before each Council meeting would be very useful to the UK.

7. I have a further critical comment to make on the way the UK managed its negotiations on joining ESRF.

The UK is well known by its national partners to take a particularly hard look at the justification of the budget level. This is quite appreciated. The Kendrew Report on CERN for example set a UK lead which was followed (in principle if not in practice) by the CERN's own working party.

However, the UK entered the Foundation Phase of ESRF (eventually 20 months) at a level of 15 per cent and then proposed to reduce this to about half for the 11-year Construction and Operation Phase. This proposal to halve the UK contribution, however well intentioned or even (in the context of other international agreements) justified, was a failure since it attracted suspicion and opprobrium to the UK community but in the end achieved no reduction. This apparent clumsiness can have spin-off which is counter productive. The origin of this approach is not known to me.

8. On the positive side, the UK scientific community is usually welcomed warmly by European colleagues in ISPs since at the moment UK scientists are held in high regard, in particular for their originality.

Evidence from the Ministry of Defence

COLLABORATION IN DEFENCE RESEARCH

The MOD is substantially involved in international collaboration in the defence field, as regards both research and the development of specific equipments, with a view to optimising value for money and avoiding wasteful duplication of effort. This embraces both bilateral arrangements with allied nations, and multilateral arrangements mainly under the auspices of NATO the Independent European Programme Group (IEPG) (all European nations of NATO except Iceland) and the five-nation Technical Co-operation Programme (TTCP) (US, Canada, UK, Australia and New Zealand).

THE CIVIL/DEFENCE INTERFACE

2. The work of MOD's research establishments is directed principally towards defence objectives. The distinction between defence and civil research cannot, however, be drawn with absolute precision; and MOD research establishments become associated with civil programmes mainly by pursuing lines of enquiry which potentially have either defence or civil applications, often with a financial contribution from industry on another government department. Work of directly civil application is also carried out on a repayment basis for other government departments or public authorities. The MOD's principal customer is the DTI which contributes some £25 million per year to the cost of defence research programmes with civil applications. Defence research can also influence civil programmes in cases where both have a similar end in view. An example is the IEPG co-operative technology project to develop a single international software tools interface standard, suitable for defence and civil use.

INTERNATIONAL COLLABORATION IN CIVIL RESEARCH

3. Against this background MOD's association with civil research can result in involvement in civil-orientated international collaborative work. Significant fora include the following:

GARTEUR—Group for Aeronautical Research and Technology in Europe. This links the national aeronautical research establishments of France, West Germany, the Netherlands and the UK in fields such as aerodynamics, helicopters, flight mechanics, and materials and structures. Industry is also involved. There is no central budget; and costs rest with the nation where they fall. There is a small rotating Secretariat, currently located at the Royal Aerospace Establishment (RAE). Virtually all activities are of benefit to both civil and military aviation.

ESPRIT—European Strategic Programme for Research and Development in Information Technology. The Royal Signals and Radar Establishment (RSRE) has participated in ESPRIT I and II and ESPRIT Basic Research Action.

BRITE/EURAM—Basic Research in Industrial Technologies for Europe/European Research in Advanced Materials. These are both centrally funded by the European Community on a 50/50 basis with the participating partners. RAE has bid successfully into various aspects of the Pilot Phase Aeronautics programme, using part of the DTI funded aerospace research programme as its 50 per cent contribution.

ISO—International Standards Organisation. This is a world-wide federation of national standards organisations based in Geneva. It deals with all areas of standardisation except those concerned with electrical engineering and electronics. MOD representatives participate in many of the technical panels and committees.

SPACE—Space research conducted at the Royal Aerospace Establishment, Farnborough embraces work of defence, civil and mixed application. (Work of exclusively civil application is funded by the DTI). There is a major international aspect through UK membership of the European Space Agency (ESA), and Farnborough benefits from ESA funding.

METEOROLOGY—The Meteorological Office plays a prominent role in international co-operation in meteorology. This is largely conducted within the scientific and technical programmes of the World Meteorological Organisation and through the European Space Agency. It is also engaged in various international collaborative programmes involving meteorological research studies. The Meteorological Office is the lead agency for UK membership of two scientific international organisations; the European Centre for Medium Range Weather Forecasting (ECMRWF), which undertakes research into medium-range weather forecasting and provides basic medium-range forecast guidance to the meteorological services of its Member States, and the European Organisation for Meteorological Satellites (EUMETSAT), which is responsible for running operational meteorological satellites in Europe.

OCEAN SCIENCES—The Admiralty Research Establishments is engaged in various international collaborative programmes with civil application, including the International Ship and Offshore Structures Congress, and work in ship stability, hydrodynamics for application to hull form, and ocean monitoring.

5. A major collaborative project is the European Transonic Wind Tunnel (ETW), jointly funded by the Federal Republic of Germany, France, the Netherlands and the UK, and located in Germany. This facility has potential application to both civil and military projects in the aeronautical sphere. The UK contribution to the project is funded jointly through the MOD and the DTI.

Letter to the Clerk from Professor P G Murphy, Department of Physics, University of Manchester

Dear Mr Walters,

I am responding to your Sub-Committee's request for views on international scientific programmes. I am head of the High Energy Physics group at the University of Manchester; I have been engaged in international scientific programmes since 1962.

(i) Advantages and disadvantages

Large collaborations have the resources, of finances and manpower, to tackle research problems which require facilities which are beyond the capacity of any one country; this has made it possible to carry out the most exciting front-line research. These projects attract some of the leading scientists in the world; it is beneficial to our young people to work alongside them.

There are disadvantages in the multiple bureaucracy involved, but experienced scientists have learned to cope with this.

(ii) Hosting large facilities

Agreements usually balance the obvious costs and benefits, but there are secondary benefits to local industry and general employment (housing, cleaning and maintenance, etc.). Local industry can make and maintain advantageous contacts, despite rigorous tendering procedures.

(iii) In High Energy Physics CERN, in Geneva, is an example to all international collaborations. It shows what is possible, and there it is demonstrated daily that the pursuit of a common purpose by like-minded persons is no more difficult internationally than in more parochial arrangements. A vital ingredient is that scientific decisions are made by *ad hoc* committees of scientists and not by meetings of "delegations"; there are no "official UK" views on the scientific matters which are under consideration.

(iv) In High Energy Physics scientific programmes are initiated by proposals made by scientists which are discussed openly, then decided by committees composed of knowledgeable scientists. This is true not only at CERN, but also at similar nationally-owned facilities in the USA, the USSR, Germany and Japan. The finances are managed at CERN according to procedures and policies determined by international agreement. For national facilities bilateral agreements between bodies like the SERC are made—this is also true for non-member states using CERN (ranging from the USA to Outer Mongolia).

(v) Forums

See (iv). Open meetings are held in which proposals are criticised, often by competing groups.

(vi) and (vii) I have no comment on these, except that one of our difficulties is finding out what the appropriate Treasury rules and rulings are.

(viii) The use of government rates for housing, travel and family costs is convenient but expensive. Currency fluctuations cause nightmares, as agreements usually refer to one particular currency, while individual budgets are fixed in national currencies. In High Energy Physics it is universally established that all results are published in open literature.

(ix) We negotiate with scientists in other countries to set up collaborations. The negotiations are often tough, but always based on scientific criteria.

National budgeting procedures vary widely. Some countries (USA, Japan) only fix their budgets annually, introducing some uncertainty into long-term planning. The fact that different countries start their financial years on different dates sounds like a complication, but it can be used to advantage to smooth out temporary difficulties.

Footnote

As well as the various advantages which I have described, there is one more general benefit. In the words of my long-term Japanese collaborator "it is one small way in which we can help to make wars impossible".

Yours sincerely,
P G Murphy

**Letter to the Clerk from Professor Anthony C T North,
Astbury Department of Biophysics, University of Leeds**

Dear Sir,

Summary

1. International programmes can provide support for research programmes that is not otherwise available.
2. Arrangements for establishing such international programmes are generally over-complex.
3. Most participants, including industrial participants, prefer one-to-one arrangements to multi party arrangements.
4. It is not clear how advice is sought to form the basis on which applications are accepted or rejected.
5. Acceptance of proposals should be based on their intrinsic merit from a *scientific* point of view, not on political considerations.
6. Information about international programmes is often expressed unclearly and is out of date.
7. The interval between publication of information on new programmes and the deadline for receipt of applications for funding is often impossibly short.
8. The combination of a number of the above factors gives rise to a strong suspicion that decision-making processes are unfair, with significant advantages accruing to those with "inside information" in the planning of initiatives and formulation of policy.

Value of international programmes

There is no doubt that international collaboration *can* support areas of science that would not otherwise proceed. Nevertheless, many projects supported through EC programmes, for example, appear to be contrived, particularly when they have been formulated in such a way as to include partners from less-developed countries in EC terms (e.g., Portugal and Greece) purely for the sake of improving the chances of gaining funding. At the same time, it seems very difficult indeed to gain financial support on a relatively modest scale for such aspects as tuition fees and maintenance grants for postgraduate students from EC or non-EC overseas students to enable them to work for higher degrees in the UK.

Flexibility of arrangements

The apparent requirements with any EC programmes to involve both academic and industrial partners in more than one country makes such programmes extremely complicated and time-consuming to set up and, in any case, many industrial companies prefer not to be involved in such broad collaborative arrangements, preferring one-to-one collaborations with academic partners.

Criteria for consideration of proposals

First, it is evident that proposals are *not* judged purely on their scientific merit, but that "political" considerations are very important: yet apart from a belief that it is advantageous to include less-developed countries in collaborative programmes, it is not at all clear to applicants how large a part this plays in the decisions for funding and there is considerable concern that projects that are relatively poor on scientific grounds nevertheless get funded if the choice of partners is seen to be "right". However, the weight attached to the latter criteria is not made clear to applicants, though it ought to be.

Who assess the applications?

It is not at all clear what mechanisms are employed by organisations such as the EC in the judgment of applications. Whereas the methods employed by UK Research Councils and similar bodies are well understood (specialist committees and the use of a number of referees for each proposal) it is not known whether comparable peer-review procedures are used by the EC. How big a role do the officials of the EC play? How widely do they consult? What kind of people and from what countries do they consult? I know of very few occasions when my colleagues or I have been consulted in any way, so fuel is added to the suspicion that an inside line to Brussels is more important than it should be. There is also a strong suspicion that powerful "in-groups" within a country can have too much influence over which institutions receive support.

Information about international programmes

Information about the criteria to be used is often unclear, it is not sufficiently clear just what types of project would be considered favourably and what criteria are to be used, the deadlines for submission of cases are often impossibly short (for those who have not acquired inside knowledge about forthcoming programmes) and decisions are often reached very late in relation to the intended starting date of the projects.

Impediments to collaboration

One matter not referred to in your letter is the quite intolerable delays in obtaining work permits for non-EC nationals to work on fixed-term contracts in scientific research. What is not clear to us is whether this is simply appalling inefficiency on behalf of the Home Office or whether it is a deliberate attempt to make it difficult to employ non-EC nationals, but it is quite unacceptable that there should be delays of six months or more in granting permits in straightforward cases.

In an attempt to summarise, some research projects funded through international scientific programmes are projects that genuinely involve and require international collaboration, others are somewhat spurious and are set up purely as an attempt to exploit another potential source of funding, whereas they could better be funded from national research council budgets; for this reason at least, it is most unfortunate and undesirable that the national and international budgets should be in competition for a share of a fixed science vote.

Doubts about the validity and integrity of the decision-making processes of the international bodies mean that scientists are not confident that they operate in a fair and informed way in reaching decisions, the main criteria for which should undoubtedly be the scientific value of the proposals.

Yours faithfully,
A C T North

Letter to the Clerk from the Head of R&D, Ordnance Survey

Dear Sir,

I have been asked by Mr Peter McMaster the Director General of Ordnance Survey to reply to the letter from Mr R H Walters seeking evidence concerning International Scientific Programmes (ISP).

The Ordnance Survey (OS) has only been involved to a very limited extent in the type of ISPs which are described in the letter. OS has limited itself to participation in programmes seeking specific results which OS can use in pursuing its role as the National Mapping Agency and more frequently can use to improve or maintain its commercial position. In investigations of the latter type preserving confidentiality becomes a significant consideration.

The OS R&D programme is designed to maintain progress towards the achievement of the corporate objectives through the development of emerging technologies and the introduction of new processes and techniques when technically effective. It is more concerned with research which has a specific research aim and consequently has little need for collaborative programmes beyond those which are arranged with Universities in this country where the investigations are directed towards our longer term interests.

With limited resources to be spent on R&D (under £2 million) of which the greater proportion is spent on experimental development, the opportunity or the necessity to become involved in ISPs has arisen infrequently.

The only recent ISP which fits the terms of reference with which OS has become involved has been a small part of the EC DRIVE programme concerning databases and specific aspects of data content in which there were three UK participants and two European participants. This project had specific objectives which were closely related to our wish to bring out a product for the in-car navigation market.

At present we are participating in a project to determine the accuracy and suitability of reference spheroids and geodetic networks through collaboration with our European counterparts. Programmes such as these are designed by agreement between participants with each country funding and carrying out its own observing programme and contributing to the cost of the computation and adjustment of results.

OS has collaborated in projects arranged and managed by international organisations concerned in matters which are closely related to our field of endeavour. These projects appear to fall outside the remit of Sub-Committee II because there is no element of direct government funding and they have specific objectives in a very limited practical field of application. OS participates as a world leader in the survey and mapping community and from time to time takes the lead position when the work is of immediate concern to us. Recently OS has provided a Chairman for a Working Group on Revision using Photogrammetry for a Commission of the International Society for Photogrammetry and Remote Sensing and we have

established a Working Group on Map Revision within CERCO which is the organisation which represents Heads of European Survey Departments. In the past we have participated in work with the International Cartographic Association and the International Federation of Surveyors.

I hope I have given sufficient details to show that although we do have interests which we pursue internationally, they are followed within a community closely concerned with matters which relate to our work and are not really appropriate to the wider concerns of ISPs. Consequently it is not possible for OS to give answers to your specific questions from the benefit of our experience.

Yours sincerely,

M Sowton

Supplementary evidence from the Queen's University of Belfast

UK SCIENCE POLICY AND EUROPE

I refer to your communication N/90/105 dated 14 May 1990 requesting detailed written evidence about difficulties faced by universities because of the lack of provision from UK sources of funds to match the 50 per cent funding of EC contracts by the European Commission. The situation here at Queen's is that the University has strongly encouraged staff to apply for grants for EC projects/contracts. In view of our geographical location, we feel that it is essential for us to increase our involvement in Europe and we believe that EC projects/contracts are an ideal medium for achieving this aim.

A number of universities which have attempted the full costing approach to EC contracts have had their costings challenged. In particular the EC has refused to accept the methodology of the 1988 CVCP/Hanham report. The main areas of difficulty relate to the separation of time spent by university staff on teaching from that spent on research and also the way in which the costs of existing university buildings are accounted for. We understand that discussions aimed at resolving these problems, involving DTI and others, are continuing. In the meantime Queen's, in common with a number of other UK universities, has opted for the alternative marginal costing method permitted under the EC contract conditions.

We are concerned that under the marginal cost option, 20 per cent for overheads is quite insufficient to cover indirect costs. Another serious problem is that Article 27 of the EC Model Contract allows universities to recover the costs of most durable equipment at a rate of only 20 per cent each year. Thus, on a three year contract, only 60 per cent of equipment costs are recoverable. The shortfall of 40 per cent has to be found from elsewhere and, in practice, it often comes from the already inadequate 20 per cent allowed for overheads. To date we have in all cases secured funding for the shortfall on EC contracts from departmental or other university sources and, upon occasion, from outside bodies which have specific interests in the area covered by the project/contract. We have not so far failed to pursue EC contracts to their final negotiation stage solely on financial grounds.

We are of course extremely concerned that, in future, EC contracts may have to be rejected in view of the inability of the University to secure funding to meet the additional resource requirements and we fully support the efforts being made by CVCP to draw the Government's attention to the problems which all universities face in this respect.

Evidence from Dr P J Roach, Department of Linguistics and Phonetics, University of Leeds

(i) The cost of bidding for a grant from an ISP is enormous, and represents a very high-risk gamble given the small proportion of applications to initiatives like ESPRIT that get funded. Some assistance to poor departments to enable bidders to travel to overseas meetings of fellow-applicants would be fairer than the present system, where rich departments do best.

(ii) For collaborative research with (newly free) East European nations it is almost essential to loan or give equipment. In my own IBM project (with the research to be based in Poland) the Cocom regulations on exporting even low-level computing equipment are obstructive, petty and out-of-date.

Dr P J Roach

Letter to the Clerk from SERC

Dear Mr Walters,

As promised during my recent appearance before the Select Committee, I now enclose additional information regarding the means by which SERC provides support for the initiation of small-scale international collaborative programmes and some examples of projects that have developed in this way.

The earlier written submission from SERC mentions that the Council supports international activities both through informal collaborations between individual scientists and their counterparts throughout the world and by contributing to major international facilities.

The mechanisms by which SERC provides support for informal, individual collaborations are briefly described below and some examples are included of specific projects within Council's Science Board and Materials Commission areas which have recently benefited from these schemes.

Individual collaborative projects are supported mainly by the provision of research grants. These may be awarded either to cover solely the costs of travel and subsistence to enable researchers to visit colleagues overseas or such costs may be provided as part of a larger grant supporting a project in which transnational collaboration is a vital element. Travel only grants require the beneficiary to submit a brief report of the outcome of the visit, including an assessment of the opportunities for any international collaboration. In addition, Visiting Fellowship research grants are available to meet the costs of visits to UK HEIs by scientists and engineers of acknowledged standing.

Another means by which SERC encourages the development of international research projects is through the support of informal discussion meetings, comprising a small number of representatives from each side, on a research topic which the Council considers to be of particular interest. These gatherings, which usually comprise between five and ten representatives from each country are normally, but not exclusively, bilateral and are commonly referred to as "n+n" meetings.

Examples of International Collaborations:

(a) SERC Science Board—Chemistry Committee Area

The Committee has established a three-year programme of "n+n" workshops for young chemists with the USA National Science Foundation (NSF). The workshops, which will be held twice yearly on specific topics, have as one of their aims to promote North Atlantic collaboration among young chemists who are just beginning to become established in their respective fields. The programme has only recently started and to-date one workshop has been held, although three took place under a pilot scheme in 1989. The workshops have generally been judged to be successful and UK workshop organisers will monitor the development of research collaborations arising from the programme.

Through the SERC, UK chemists are participating in drawing up an EC Committee on European Co-operation in Science and Technology (COST) programme in Chemistry and have also established a European Group (CERC3) to explore avenues for collaboration.

As regards research grants, since 1985 the Chemistry Committee has awarded 33 Visiting Fellowship Grants, nine of which were for visiting Americans or Canadians. During the same period 39 overseas travel grants were awarded by the Committee, of which about 30 per cent enabled UK academics to visit the USA, and 35 project-based grants and overseas short visit grants were awarded, an integral part of which was to encourage international collaboration.

Some examples of specific grant awards are included at Annex 1.

(b) SERC—Materials Commission Area

A collaborative project between Professor D Bloor of Queen Mary College, University of London, and Professor Aizawa of the Tokyo Institute of Technology, is currently supported by a three-year research grant award. The project aims to elucidate the fundamentals of fabrication of bioelectronic devices.

Another collaboration, involving the Tokyo Institute of Technology and Nottingham University in the production of organic thin films based on phthalocyanines for potential device applications, is currently in receipt of research grant funding.

M H Richmond

ANNEX 1

Chemistry Grants 1985-90 involving collaboration with the USA

Dr P B Davies, Cambridge

Tunable for infrared spectroscopy
£53.7k over two years

Dr G M Blackburn, Sheffield

Kinetic and NMR studies of α β methylene analogues of nucleotides binding to DNA
£1,500 over six months

Dr K G McKendrick, Edinburgh

State to State collision dynamics
£691 over three months

Dr J A Joule and Professor C D Garner

Synthesis of the co-factor of the oxomolybdo enzymes
£48.9k over three years

Professor L D Barron, Glasgow

Natural and magnetic Raman optical activity
£74.8k over three years

Dr D Bethell, Liverpool

Quantitative studies of reactivity in cation radical/nucleophile reactions £1,754

Dr P Edwards, Cardiff

Chemistry of complexes with chelating phosphido and amino ligands
£1,500

Dr J N L Connor, Manchester

New theoretical methods for chemical reactions and the spectroscopy of the transition state
£39.0k over three years

Professor S F A Kettle, East Anglia

Inelastic neutron scattering measurements on halocupates
£1,465 over 12 months

Mr P Hollins, Reading

Infrared spectroscopy at the Brookhaven National Synchrotron Light Source £1,648 over 12 months

**Evidence from Dr Celia Scully, Department of Linguistics and Phonetics,
University of Leeds**

ISSUE (VIII): IMPEDIMENTS WITHIN THE UK

Personal experience of:

- (1) A current EC-funded collaborative research project with partners in France and the UK.
- (2) The current preparation of an application for an ESPRIT Basic Research Action project, with nine partners in six EC countries (and two partners in one EFTA country).

Problems experienced:

- (1) Currency fluctuation means that planning for the number of months of employment that can be offered to potential staff cannot be made with confidence, based on an award made in ECU. This problem is exacerbated when research staff come from another EC country, as under the rules of my current project. This genuine inter-country collaborative working is an excellent concept, which ought to be fostered and helped, not made difficult.
- (2) In the planning of a large ESPRIT project, an equitable distribution of resources must be sought, so as to foster from the start a spirit of comradely co-operation. A convenient way of achieving this is to allow equal funding per researcher to be employed. Now the inflation rate is so much higher in the UK that we UK partners do genuinely need about 10 per cent extra funding to cover extra costs for the same research effort. I shall have to argue this in the next few weeks, with much regret, at the risk of appearing to want more than my fair share of scarce resources.
- (3) The large extra sums needed for overheads will certainly cause problems in all future project applications. At present marginal funding is used by the University of Leeds; the alternative of 50 per cent of full costs seems almost certain to be used in future, since the present 20 per cent overheads, fixed at this rate by EC rules, is totally insufficient for the true costs of research in a university. This is very particularly the case for the department in which I work—within the Faculty of Arts. The University of Leeds considers that this department should obtain overheads of 100 per cent for support of research. It is my understanding that overheads of this magnitude are not required or expected in other EC countries. Under these circumstances, which may well apply to the current ESPRIT application, I shall need to ask my European partners for not much less than double funding. This will be straining the tolerance of other partners beyond what is acceptable; I cannot believe that UK investigators are, in general, worth twice that of their peers in other countries!

Dr Celia Scully, MIOA

28 June 1990

Evidence from the University of Sheffield

1. Advantages and disadvantages in joining ISPs, to the UK, to the funding department and to the participating institutions.

International Scientific Programmes (ISPs) are of vital importance to the UK scientific community. They enable the UK to participate in projects which would be too large for the UK alone to fund; the European Space Agency is a good example. In this way, they offer an additional source of support for UK research, over and above the basic science budget. They also provide UK researchers with access to expertise and facilities which are not available within the UK and contribute to the international transfer of technology and knowledge from which the UK benefits. It is also important to stress that ISPs, by bringing together the expertise and experience of researchers from varying national and cultural backgrounds, often provide a further insight, broader than a single UK perspective. For the future strength of UK research, the opportunity to participate in ISPs also offers an exciting prospect which helps to attract and retain the best staff and students.

The main problems concerned with ISPs relate to the time and effort required in a period of scarce resources in setting up and managing such programmes. Bringing together staff and institutions from different countries with varying funding arrangements can be extremely demanding, requiring strong commitment from those involved. Those involved with the actual management of programmes face particular problems. The need to satisfy administrative requirements in various countries can be a major obstacle and very frustrating for those involved. Within universities, involvement with ISPs has necessitated the development of new administrative services, able to deal with international business and legal practice.

2. Advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institutions.

It is important that the UK takes an active role within ISPs. In order to obtain the maximum benefit from such initiatives, the UK should also house major facilities. These will attract leading researchers to the UK and by enhancing the standing of UK research will work to the benefit of the whole scientific community. It is, therefore, of some concern that, to date, the UK does not seem to obtain "its share" of such facilities and is notable for its inability to be proactive.

3. The machinery whereby international programmes are set up and its adequacy in the UK.

If the full advantages from participation in ISPs are to be obtained, it is important for UK researchers and funding bodies to take an active role from the outset, including the origination of a programme, and throughout the programme development. Too often, the first steps are taken in other countries; by the time the UK becomes involved, "the dye is cast" and the lead is taken by other researchers.

In the UK, the Research Councils still operate essentially in a responsive mode. This means that a programme has to be set up and fairly fully defined before a grant application is possible. At this stage, a decision will be taken whether or not to fund the UK share of the programme in question. Commonly, discussions between potential collaborators will be well advanced by this time. The effect of a decision not to provide funding can be very serious and, by reducing the confidence in UK research support, makes future collaboration very difficult.

If the UK is to take a leading role in ISPs, it is important that funding is available at an earlier stage in the deliberative process. More flexible funding arrangements are also needed. For example, the SERC limit of £25,000 below which it is not normally possible to get a research grant, makes it very hard to bid for "pump-priming" funds, necessary if UK researchers are to participate fully in initial meetings for setting up an ISP. Against this background, UK scientists rarely feel able to take a leading role in setting up collaborations.

4. The technical and financial criteria under which proposals for ISPs are presented and considered.

A major problem facing UK scientists who wish to participate in ISPs is the expectation often encountered in discussion with overseas collaborators of substantial institutional commitments. UK universities do not have the resources to support their staff to the necessary extent. Similarly, there is a strong view that support from Research Councils is inadequately funded. This often leads to wasted effort by the researchers involved.

5. *The forums in which the decision to participate in ISPs is normally reached.*

It is important that UK Research Councils take a more active role in initiating programmes at the international level. There are some signs that this is beginning to happen. However, it is important that those involved in shaping research policy look towards international collaboration as a normal part of research activity and as something to be both expected and encouraged. At the level of the institutions involved, it is important to develop a more collaborative approach. Again, international involvement should be encouraged and expected.

6. *Government practice and guidelines in ISPs—how they apply and how widely they are known and accepted.*

The view of UK Government practice and attitudes held by potential international collaborators is a major obstacle to UK participation and ISPs. Many collaborators believe that the UK is not interested in such collaboration. As a result, the UK scientific community is too often on the fringe rather than at the centre of ISP development (see 2).

The dual support system presents particular difficulties in the establishment of ISPs. Foreign funding bodies and collaborators do not understand the system. It is often difficult to establish the real financial contribution of the UK to particular programmes, especially the real value of staff time and institutional overheads.

7. *Treasury rules of additionally and attribution—how they apply in respect of ISPs and the Science Budget and how they treat inflow of foreign money.*

These rules are not widely known or understood within the scientific community.

8. *Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing, travel and family charges, exposure to currency fluctuations, commercial secrecy and intellectual property rights, COCOM restrictions.*

The low level of UK salary scales is a major problem which inhibits effective participation in ISPs. As a result, there is often a net outflow of personnel. Ideally, the best researchers from other countries should be encouraged to work in the UK through an ISP. Unfortunately, all too often, they are deterred by UK salary scales. Experience of ISPs within the European Community indicates that there is a net outflow of researchers to countries like France, Germany, Holland and Italy; a net inflow probably exists only with Spain and Portugal. Again, therefore, the UK is unable to obtain the full benefit of participation in ISPs through the transfer of skills and expertise from overseas researchers who would otherwise work in the UK.

Currency fluctuations are another important problem especially at the point of negotiation. Instability in the currency causes uncertainty and delay in the establishment and operation of an ISP and is a constant source of concern for those involved.

COCOM rules can be a difficulty for particular ISPs. The main problem seems to be that advice from the Department of Trade and Industry (DTI) can often be ambiguous or confusing, and sometimes even contradictory. This leads to delays and difficulties, and can deter involvement in ISPs. Cases can be cited of considerable effort being expended in preparing detailed submissions to the DTI for licences, only for the applicants to be told that the licence was not needed after all. It appears that DTI staff do not have the necessary technical understanding to provide authoritative advice in such cases.

9. *Impediments in other countries to their engaging in ISPs (EEC, Commonwealth, USA, Eastern bloc) e.g., concern with national benefit and protectionism, problems posed by national budgeting procedures.*

Within the Eastern bloc countries, a lack of hard currency for travel makes it hard for their scientists to take a full part in ISPs. This can be extended to other shortages; for example, there is a lack of paper within the USSR at present. Poor communications to the Eastern bloc is a further major problem for ISPs involving these countries.

There is a widely-held view in the UK academic community, that the administrative bureaucracy in the USA is a major deterrent to ISPs.

In some countries, national pride is a problem which stifles their involvement in ISPs. Commonly such pride results in the country concerned not obtaining the maximum benefit from involvement in the ISP.

21 July 1990

Two letters to the Clerk from Dr K A Shore, School of Electronic and Electrical Engineering, University of Bath

Briefly, I wish to suggest that consideration be given to broadening the scope of collaborative schemes of the kind which are currently funded by the British Council. What I have in mind are the bi-lateral schemes which exist, e.g., between the UK and Spain "Acciones Integradas" (similar schemes exist for collaboration with Germany (ARC) and France (Alliance)).

At the moment the partners in these schemes receive travel and subsistence costs only—and those are not particularly generous. I believe that there will be a considerable benefit from arranging that money is available to pay short-term salaries and minor equipment costs within these schemes.

There is a simple but cogent argument in favour of the above suggestion. Firstly, there is considerable goodwill between scientific workers in Europe in regard to collaboration. Now although there is considerable financial support available within the EC one factor undermines the enthusiasm of potential collaborators: bureaucracy. Here the British Council shows an excellent example. The application process is simple but nevertheless selective—it is essential to submit clear ideas with a precise timetable. In a word the system is effective except for the fact that, of necessity, the targets of the schemes must be limited. By allowing comparatively small additional payments, it will be possible to considerably enhance the productivity of work done under bi- (and possibly multi-) lateral schemes.

If more information is required in the near future I can be contacted at addresses (supplied to Dr Walters) in Denmark—where I will be working on a collaborative project *not* funded by the British Council.

I hope that these comments are of some value to the Committee.

Yours sincerely,
Dr K Alan Shore

In your letter of 19 July 1990 you asked for examples of the bureaucratic nature of EC-funded collaborative research programmes, I would highlight two points:

1. *Timetable for Submissions*

The deadlines for submissions are not decided/published sufficiently far in advance to permit proper preparation of an application. It is essential therefore to have assembled a collaborative consortium and to have prepared a reasonably detailed project proposal *before* the “Call for Proposals” appears. The problem is that the call may not then come and the preparatory work will be wasted—not least because priorities for research can easily change.

I am myself currently in this position. I have maintained contact with Brussels in respect of a specific programme (the ESPRIT Basic Research Action) for over two years! My latest information is that a call may be forthcoming in “early 1991”. I hope that the consortium I assembled in March 1988 will stay together until then. Hopefully British Council money will permit me to maintain contact with some of the partners.

2. *Critical Mass*

EC collaborations generally involve at least four or five groups in perhaps three or four countries. Hopefully such collaborations involve active research workers who by definition, will be very busy. Quite extraordinary problems may then arise in arranging joint meetings at which all collaborators can be present. Simply making those arrangements can use up substantial resources in manpower and fax-paper. The manpower resources wasted in this way are perhaps the very people who are actually being funded to do technical work on the project. (Very few universities have sufficient spare secretarial resources to undertake such duties). It would seem more sensible to support smaller groupings for which such problems can be significantly reduced.

Yours sincerely,
Dr K Alan Shore

Evidence from Deputy Principal, Professor J R Small, Heriot-Watt University

This response from Heriot-Watt University confines itself to R&D contracts awarded by the European Commission.

Heriot-Watt University is anxious to contribute fully to European development and integration through increased participation in European Community R&D and other programmes. To our great regret, however, we are constrained in making concerted efforts by the low level of funding currently obtainable from the EC for R&D contracts.

The British Government requires universities to charge full economic rates for contract work but it is not possible to obtain funding at this level from the EC, particularly under the Marginal Cost formula which offers only a 20 per cent overhead rate. The 50 per cent of Full Costs formula would be more attractive but after protracted negotiations with the Commission, we have been unsuccessful in agreeing a basis on which this formula can be applied.

It is unlikely the EC will alter its funding policy since the UK is very much in the minority in expressing its dissatisfaction. The only solution to universities' problems in this respect would therefore seem to lie in the UFC providing funds to make up the deficit.

Given the unsatisfactory funding situation and the disenchantment felt by many of my colleagues with the bureaucracy surrounding EC contracts, Heriot-Watt University is unlikely to seek to participate as fully in future EC R&D projects as it would wish. If, as would seem to be likely, many other British higher education institutions adopt the same position, the UK will end up in a situation where it is contributing considerably more to the EC R&D budget than it receives back by way of contracts.

J R Small

Evidence from the Society of British Aerospace Companies Ltd

EXECUTIVE SUMMARY

On behalf of its member companies, SBAC considers that to participate in International Scientific Programmes (ISPs) in a responsible way that befits the Nation, the first and most important requirement is that there should be a Government (DTI) initiated long-term industrial strategy which sets out quite clearly the priority areas for Government investment and, from that, the appropriate topics for collaboration.

Such Government strategy should incorporate a balance between the benefits of collaboration and the competitive edge generated by national investment.

There should then be a process to integrate the strategy with the product strategies of major industrial concerns.

RESPONSE

It is assumed that the Committee's scope includes International Civil Scientific and Technological Research Programmes, wholly or partly funded from government sources, e.g., ESPRIT, EUREKA, Euromart, Brite/Euram, ESA, ETW.

(i) The Advantages and Disadvantages in joining ISPs

Advantages:

- Reduces cost of technology acquisition.
- Promotes understanding amongst the participating organisations.
- Enhances confidence for Industry and funding department that proposed programme is technically sound and cost effective.
- Enables Industry to improve its knowledge of the technology capability and future objectives of its competitors.
- Broadens Industrial horizons and provides greater leverage than could be sustained by a UK programme.
- Enhances potential for a beneficial return, in terms of results, from the individual participating organisation's investment of manpower and/or funding. Typically, 50 per cent of the cost of the work undertaken is provided by an external funding agency.
- Promotes benefit to enabling technology research.
- Provides larger pool of scientific talent and higher quality technical stimulation.
- Attracts challenging technology programmes to UK Higher Education Institutes (HEIs) and encourages HEIs to be more competitive in cost, quality and innovation.

Disadvantages:

- Increases risk of technology leakage from Industry and from UK HEIs to competitors.
- Gives poor support for innovation.
- Leads to the industries of developed nations inevitably handing over their expertise to those of less developed nations.
- Highlights difficulties in IPR issues.
- Requires significant investment from participating Industry in terms of funding internal work and expertise which may not result in subsequent commercial benefit.
- Enables competitors to improve their knowledge of UK Industry's technology capability and future objectives.
- Involves substantial up-front "overhead" for Industry, often without the reward of a contract.
- Reduces cost effectiveness and technical cohesion of the programme as a result of compromises inevitably necessary where many companies and HEIs are involved.

(ii) *The advantages and disadvantages of hosting large facilities*

- Given that the facility is seen as being supportive of a national strategy, Industry sees a significant net gain from hosting a large facility by enhancing the host country's industrial infrastructure.
- Unfortunately, the UK record on hosting is poor and, therefore, funds for facilities abroad are being drawn from UK research budgets.
- UK should actively seek to host as many facilities as is compatible with its overall strategy. A potential candidate is the Ultra High By-pass Ratio (UHBR) rig currently being proposed by R-R/RAE for BRITE/EURAM funding.

(iii) *The machinery whereby ISPs are set up and its adequacy in the UK*

- The machinery varies substantially in quality and effectiveness but even the better examples are cumbersome.
- Once established, the administration of ISPs compares favourably with UK procedures and practices.
- In the case of the Brite/Euram Area 5 (Aeronautics) ISP, European aeroengine companies support a senior executive to work nearly full-time in Brussels to interface with the CEC.
- There has been strong collaboration between the (partial) funding agency and Industry participants, e.g., DG XII-H of the EC and Industry.
- There has been strong Industry collaboration to produce a proposal for submission to the EUROFAR Project in the EUREKA programme initiative.
- HMG machinery has appeared inadequate, particularly in the consultation with Industry in defining subject areas of a programme prior to its launch, e.g., EUCLID. However, there has been some improvement recently, and DTI now maintain a better awareness, for example, of Brite/Euram programme.

(iv) *The technical and financial criteria*

- For CEC programmes, the criteria are generally well defined and clearly presented.
- However, occasionally criteria can strongly favour Industry of lesser developed countries at the expense of UK companies who invest heavily in efforts to sustain a technological lead.

(v) *The forums in which the decision to participate is normally reached*

- The CEC created forums are fairly well organised.

(vi) *Government practice and guidelines on ISPs*

- There seems to be a marked reluctance from HMG to support specific ISPs or the UK industrial initiatives being taken in respect of these.
- Refer also to (iii) above.

(vii) *Treasury rules of additionality and attribution*

- It seems that other European and the US governments give substantial financial support to near market product development which is different from the UK's market forces approach.
- HMG are, effectively, applying "claw-back" to current HMG funding.

(viii) *Impediments within the UK to engaging in ISPs*

- Currency fluctuations have caused minor problems (Brite/Euram contracts are in ECUs) but steps can be taken to avoid the adverse effects.
- Industry would be unlikely to participate in an ISP if commercial secrecy is an issue.
- Careful and time-consuming contract negotiations are necessary in order to avoid major problems with IPR and the issue needs to be resolved early on.
- Problems for the UK participants stem from the relatively low salary scales enjoyed by UK scientists and engineers which result in UK participants contributing much greater value for money than their international partners, sometimes by a factor of around 40 per cent.
- Refer also to comments relating to IPR in (i) and (iv) above.

(ix) *Impediments within other countries to their engaging in ISPs*

- Protectionism in the US requires careful negotiations and administration, otherwise UK industry suffers from being unable to secure proper information.
- The requirements by participants from certain other countries to lead and manage research programmes stemming usually from the fact that they are already some way ahead on particular research subjects benefitting from prior national funding support.

Evidence from the University of Strathclyde

(1) The advantages of joining ISPs for the University are:

- (i) They give the University access to a much greater base of knowledge.
- (ii) They stimulate lateral thinking.
- (iii) When industrial partners are involved in collaborative projects it helps to break down the "them and us" attitudes between academic staff and their industrial counterparts.
- (iv) They have become an important component of a University's research budget.

All of these are of direct benefit to the UK.

The disadvantages are minimal provided that ISPs allow costs to be recovered on an adequate basis, and allow issues relating to Intellectual Property Rights (IPR) to be handled in a manner sympathetic to a University's needs.

(2) The hosting of large facilities is something of interest to a University provides the facility is genuinely needed in the academic scene and is associated with medium to long-term technical market needs. If not, such facilities rapidly become a financial burden. The original sponsor often only wishes to provide full funding in the early stages, leaving an increasing commitment to be met by the institution in the long term.

Large facilities need to have freedom to evolve in both technological and financial senses. They have to be genuinely international in service and on this basis would be attractive, at a national level, to a country such as Scotland, particularly if the function was likely to support existing and incoming companies through scientific research and development. Large facilities can be expensive to terminate.

(3) The formation of national and international schemes always seems to be flawed in that the organisations with the most hands-on experience in such programmes are rarely consulted before hand. Universities always end up fighting rearguard actions in attempts to improve established ISP rules which weaken the motivation of key ISP players.

The problems do not just centre around IPR, but also involve the working relationships between Universities and Companies and the whole process of the exploitation of the results. Most ISPs and NSPs have rules which effectively omit detailed consideration of the process of exploitation. Rules of thumb that assume that Universities have no interest in or experience of exploitation, and that companies will automatically exploit are sometimes the complete inverse of what actually is the case. Universities often have a broader field of interest than companies.

(5) At Strathclyde University there is an overall policy which encourages staff to involve themselves in collaborative ISPs; the decisions on projects are made by the local academic team in conjunction with specialist advice within the University's administration. Increasingly, the University's overall policy is being restricted by its inability to recoup costs on any one scheme thus demanding excessive contributions from its own resources.

(6) Government practice and guidelines on ISPs are not well known. Strathclyde University made its own decisions with respect to EEC programmes, SDI programmes, Boeing Offset Deal, etc., without any effective help from government.

(7) Treasury rules of additionality and attribution are seen as means whereby UK government research funding can be minimised. Attribution seems to mean DTI research funding is reduced as the UK contribution to EC research budgets is increased, and this is a distinctly depressing policy, especially when the missing 50 per cent funding on EC projects is overlooked by the UK Government thus leaving Universities to consider using their already overstretched UFC block grant monies for purposes for which it was never intended. This disadvantages them in comparison with other European Universities most of whom do receive the supplementation from government sources.

Additionality prevents retrospective funding. While this eases the task of the Treasury, it can make the task very difficult and expensive for Universities wishing to keep contract research teams in place while decisions are made elsewhere.

(8) Our views on the impediments within the UK to engaging in ISPs are represented on the attached paper which was sent to the House of Commons Education, Science and Arts Committee Inquiry into UK Science Policy and Europe on 8 November 1989 (*not printed*).

**Letter to the Clerk from Professor F W Taylor, MA, DPhil,
Department of Atmospheric, Oceanic and Planetary Physics, University of Oxford**

This is in reply to your letter (ref HST/1) of 21 June describing the Call for Evidence of the House of Lords Select Committee. It would appear that our large international space experiments may be an example of a relevant ISP, for example the Improved Stratospheric and Mesospheric Sounder for NASA's Upper Atmosphere Research Satellite. I enclose a copy of a popular article which describes the programme in outline. The main advantages to the UK are obtaining a "free ride" into Earth orbit (the UARS programme is costing nearly \$1 billion), and access to infrastructure and technology not otherwise available here. Of course, the benefits are in both directions: the US programme receives a free instrument (worth over £10 million in the case of ISAMS), and frequently we are able to make technology transfers in the other direction—as with the pressure modulators and closed-cycle coolers of recent note. Also, the scientific data from our experiments is made freely available to the US scientific community as well as our own. No exchange of funds is normally involved, however.

I am not sure what is required at this stage—one could write volumes under the heading supplied, about ISAMS alone, obviously impractical even if one could be sure the Committee will be interested—but perhaps this preliminary input is of some use.

Yours sincerely,
F W Taylor

**Letter to the Clerk from Professor Michael Thompson, DSc FInstP, Vice-Chancellor and Principal,
University of Birmingham**

We were invited to submit evidence on the above in response to R H Walters' letter to Sir Edward Parks. I write to let you have some comments which have been prepared from the views of those with direct experience of International Scientific Programmes in the University of Birmingham.

1. The main advantages in joining ISPs have been:
 - (a) The ability to obtain different perspectives on areas of research, enabling the researchers to achieve a balanced conclusion.
 - (b) The ability to draw upon sources of material, specialist techniques and facilities which are beyond the scope of an individual research team.
 - (c) The ability to expand the network of researchers by a very considerable degree, thus expanding the amount of information and experience which can be brought to bear on the project.
 - (d) As a result of all the above factors, to tackle research projects of an interdisciplinary kind which are beyond the scope of one individual or one individual institution.

2. The advantage to the UK or to the lead institution in hosting a large project of this kind is clear. It places the country and the institution at the head of an international network. On the one hand this confers status and reputation which enables the institution to attract the highest quality staff who are looking for intellectual excitement. More broadly, it contributes towards the intellectual independence of Britain and its ability to make a telling contribution to international science.

3. The usual machinery for setting up programmes has been through substantial applications to funding bodies.

4. UK salary scales are not generally adequate for attracting high quality candidates from Europe and, particularly, from the United States. Britain is not on an equal footing with other countries that might want to launch ambitious international initiatives. In the case of the Eastern Bloc, which is in an even more unfavourable position than the United Kingdom, the main problems in co-operation are hard currency, which funding bodies are increasingly having to provide themselves in order to secure Soviet co-operation, and also the lack of necessary equipment (personal computers in particular).

I attach for your information a copy of a response which I made to a recent House of Commons enquiry on UK Science policy and Europe which you might find useful. (*Not printed*)

Please contact me if I can be of any further assistance.
Yours sincerely,
Michael Thompson

Supplementary Evidence from HM Treasury

HOSTING OF LARGE FACILITIES: ADDITIONAL INFORMATION

Scientific excellence is an essential criterion for Community decisions about spending under the EC R&D Framework Programmes. There is no allocation of funds by member state—as is the case in a very large degree, for example, with support from the Structural Funds. There would be no basis, therefore, for the Community to claw back funds provided to run one project in the UK by reducing funds for other projects in the UK; and there is no reason to believe that this happens. The level of UK receipts reflects the ability of UK research institutions to compete for Community funds, rather than any decision to earmark particular amounts to particular member states.

2. As with all receipts from the Community budget, the UK's receipts in respect of R&D are taken into account in the calculation of the abatement of the UK's gross contribution to the EC budget. However, on past experience, the UK can expect to receive from a Framework Programme broadly the same amount as the addition to its contribution to the budget which results from a new Framework Programme. Taken as a whole, therefore, decisions about new Framework Programmes can be expected to have a broadly neutral effect on the UK's abatement.

HM Treasury

January 1991

Evidence from Professor K J Turner, Department of Computing Science, University of Stirling

(I) *Joining ISPs*

The Department has participated in programmes such as ESPRIT and COMETT, and is knowledgeable about other programmes such as RACE, DELTA, RARE, and EUREKA.

The main advantage we have found is the framework that is created for international collaboration. This is useful for broadening horizons, both technical and social.

The main disadvantages we have found are the consequent reduction in funding for national programmes, the heavy administration and travel required to support international collaborations, and the complexity of setting up international collaborations.

(IV) *Criteria for Proposals*

The major disadvantages in the criteria for proposals under ISPs are the necessity to establish a certain minimum consortium (e.g., industrial companies in two countries), and the cost of establishing a proposal (which is usually unfunded until the contract is agreed).

(VI) *Government Guidelines*

There had been insufficient help from either DTI or the Research Councils in assisting universities to join consortia and to cost their proposals. The financial aspects of ISPs are extremely difficult for universities, and national guidelines on costing would be very helpful.

Kenneth J Turner

Letter to the Clerk from the Universities Funding Council

Thank you for your letter of 2 July inviting the UFC to submit evidence on international scientific programmes.

Last year the Council published its Aims for the university sector. These included the following:

An expanding role for universities in the European Community, both in teaching and research.

On the wider international scene, an increasing role for universities in collaborative teaching and research, both in the private and public sectors.

The maintenance and development by universities of an internationally competitive position in selected areas.

The Council is not however directly involved in the participation of universities in international scientific programmes and does not provide funds specifically for this purpose. We do not feel therefore that there is much that we can contribute in response to the questions listed in the Sub-Committee's Press notice of 8 June. You might instead approach the Committee of Vice-Chancellors and Principals if you have not done so already.

If there are further questions which the Sub-Committee would like to raise we would of course do our best to answer them. /

Yours sincerely,
N T Hardyman

Evidence from the University of Ulster

EXECUTIVE SUMMARY

Participation in ISPs is considered to be of major importance generally and because of their location, particularly for Northern Ireland and the University of Ulster. It stimulates collaborative research across national boundaries, facilitates exchange of ideas and information, may strengthen the research and development base and increase opportunities for university and industry collaboration.

It is felt that Northern Ireland compared with the Republic of Ireland is at a disadvantage mainly regards participation in ISPs because of the way additionality operates in relation to certain programmes and the complexity of lines of communication (see (vii)).

Selected Issues (numbered as in letter of 8 June 1990°9)

- (i) Major advantages to participating institutions include the establishment of direct working relationships with able colleagues in other institutions and countries, the sharing of research and related facilities, the opportunity to exploit economies of scale in undertaking research projects and the possibility of enhancing links between university and industry. Disadvantages include the often late receipt of information about international programmes, and hence the short time in which to respond. In addition, the establishment of international links and the development of proposals is expensive in the commitment of time required of key personnel.
- (iv) The technical criteria for ISPs are in our experience generally sound but the financial criteria and, in particular, requirements to achieve an "equitable" distribution of funds between, on occasion, member countries may not lead to the best use of resources.
- (vi) Our experience is that Government practice and guidelines on ISPs are not widely known and that information about them should be more widely distributed.
- (vii) Additionality in relation to certain European Community funding is felt to be a particular problem in Northern Ireland. The position seems to be complicated by the financial relationship between the Northern Ireland and United Kingdom Governments in that local participation in some ISPs may not result in any increase in revenue for the Northern Ireland Government. This inhibits participation in programmes where counterpart funding is required. It is also felt that it puts staff in the universities in Northern Ireland at a disadvantage in comparison with colleagues in the Republic of Ireland.

Letter to the Clerk from Professor I C Wand, Head of Department of Computer Science, University of York

Dear Sir,

I am replying to the invitation in your letter to Sir Edward Parks of 8 June, which I received from our Vice-Chancellor, to offer written evidence on "... how the United Kingdom responds to proposals for international scientific programmes". I am responding to report my experience as the chairman of an SERC/DTI committee (Systems Engineering) which runs UK research programmes alongside their European counterparts. Unfortunately, given the work of my committee, I am unable to offer views in most of the areas suggested in your letter: here I will confine myself to the balance between the national and EC research programmes in Information Technology.

The UK runs national research programmes (called JFIT) in Information Technology jointly funded by the Science and Engineering Research Council and the Department of Trade and Industry: the programmes are run by a joint directorate advised by committee structure with a fifty-fifty mix of industrial and academic members and covers both basic and applied research. The basic is undertaken by academic laboratories (the non-collaborative programme) and the more applied work by consortia of industrial and academic members funded under so-called LINK rules (the collaborative programme). The JFIT programme attempts to consolidate the collaborations established under the Alvey programme, and is anxious to promote the involvement of small and medium size enterprises. The programme is aware of the direction and details of the EC programmes, particularly ESPRIT, but only takes the European dimension into account in general terms.

My SERC/DTI committee is particularly concerned about two aspects of the relationship between the EC and UK programmes in IT:

- (i) *Basic research:* we have been told by officials from the EC that the ESPRIT programme is built upon the assumption that each members state provides adequate funding for a basic research programme in IT. The UK no longer does this. The chances of an application for the funding of a non-collaborative project are now the lowest in any subject in the SERC. Researchers are fed-up, and morale is low. The industrial members of the committees are just as frustrated as the academic members by the present position. It is a extraordinary position to be in so soon after the build up of research capacity established by the Alvey programme.

- (ii) *Technology Transfer*: we have been told that there is evidence that ESPRIT consortia involving UK academics often do not involve UK industry, indicating that technology transfer is taking place from UK universities to non-UK companies. Apparently this trend is clear from ESPRIT II round two applications. If this effect is repeated on a large scale it will mean that UK industry is failing (once again) to exploit the results of UK research.

In summary, I repeat my point that there is no sense in UK taking part in international programmes unless there are significant domestic programmes to provide the "substrate" on which they can be built. If there are successful programmes, then UK industry must be involved in the exploitation.

I would be pleased to expand upon my points if you would like me to do so.

Yours faithfully,

I C Wand

Letter to the Clerk from Professor Sir David Weatherall, FRS, Institute of Molecular Medicine, University of Oxford

I am responding to your circular of 21 June about International Scientific Programmes. I have been involved in a few but don't really have an awful lot to offer you in response to your nine questions.

Just a few points.

- (i) In terms of carrying out serious research the best approach to international collaboration is undoubtedly on a personal basis. Joining big international bodies for this purpose is pretty hopeless and it has been quite difficult to develop really good programmes even on the various European schemes. Scientific collaborations are very personal affairs.
- (ii) I have had some recent experience in a thing called HUGO, the Human Genome Organisation. This has raised some of the problems which are encountered in setting up international bodies of this type. The initial initiative was from the USA and it was very difficult to get bodies in the UK to be willing to put in any funding. Similarly with Europe. There were considerable jealousies and tensions in who was going to chair it and when an English chairman was finally chosen there was great pressure on the UK to find accommodation, funding, and back-up. Below the surface there has appeared to be considerable tensions about how much information would be shared internationally on a rapidly growing area of science. But the human genome project is one that has enormous relevance internationally and one in which there are considerable commercial implications. I don't think government was involved at all in this and I suspect that those who were trying to do it, and who eventually succeeded through one of the charities, were unaware that there was a machinery for doing this through government, if indeed there is. Certainly if this had not been rescued by one of the charities I think the UK would have lost a very important opportunity for playing a major role in an important international scientific endeavour. And again it seems to come down to money. This particular exercise is a perfect example of how important data collection and dissemination will be for some rapidly moving areas of science. But to set up a facility like this will be very expensive. Again there are uncertainties about how government should be approached and whether in fact they are seriously interested in this kind of international endeavour.

These are just one of two thoughts but you will probably have people in the university who have had a lot more experience of this type of thing than I have.

Yours sincerely,

D J Weatherall

Evidence from Lord Weinstock, GEC

1. Introduction

As an industrial concern we do not participate in the scientific and technical programmes such as JET or NET. Our experts are sometimes involved as secondees but not as partners.

Our comments relate to participation in EEC funded collaborative research projects: ESPRIT, RACE and BRITE/EURAM.

These research projects are nominally pre-competitive research programmes involving two or more industrial partners from at least two EEC member countries and optionally can involve academic institutions.

The formulation of the work programmes, against which competitive consortium bids are sought, derives from a draft programme written by the large European industrial concerns. This ensures that programmes which are supported do have a firm relationship to industrial strategy. No such equivalent procedures and consultations exist in the UK for national programmes.

The EEC is more concerned with business reality. The DTI initiatives in the UK tend to be joint with SERC in an attempt to forge links between academics and Industry and the ground rules are highly variable. We have had UK programmes modified and even rejected because they had either insufficient scientific content or too little University participation. Yet industry has subsequently to justify grant by demonstrating exploitation on impossibly short timescales.

EEC programmes have high scientific and technical contents and are firmly rooted in business interests.

2. Responses

Our responses to the specific questions of Sub-Committee II are as follows:

- (i) *The advantages and disadvantages in joining ISPs, to the UK, to the funding department, and to the participating institutions:*

We reply as a participating institution in the UK.

Advantages are:

- (a) We can establish relevance to our own strategy by participating in the forum which draws up the framework programme.
- (b) We participate in large consortia with international peer groups, making the technical interchange large and useful.
- (c) We benefit from harmonised administration which is less onerous relative to programme size than would be the case for national programmes.
- (d) We obtain better support of the costs with full overhead recoveries.
- (e) We gain valuable insight into the post-research strategy by having the opportunity to form alliances for the exploitation phases.

The *disadvantage* of an ISP is that which is common to all collaborative programmes.

- (a) In some circumstances they may prove to be a limited constraint on a freedom for manoeuvre.

- (ii) *The advantages and disadvantages of hosting large facilities, to the UK, to the funding department and to the participating institution:*

We cannot comment.

- (iii) *The machinery whereby international programmes are set up and its adequacy in the UK:*

The machinery for setting up the programmes is based on the CEC at Brussels with UK representation on the Committees for proposing and administering the programmes. Thus both UK Industry and UK Government are represented in one committee or another.

Provided a Company is prepared to put effort in at the consultative stages the rewards at Brussels, in terms of support for relevant programmes can be great.

However the adequacy of political and administrative support and the briefing from the UK Government is sometimes less than that afforded to our EEC partners by their own Government departments. We have had occasions when UK officials have refused to divulge to us details of meetings with CEC officials, when those details related our own industrial strategy for research. Then we were forced to obtain that information from officials representing other Governments who had also briefed their own industrial concerns beforehand.

- (iv) *Technical and financial criteria under which proposals for ISPs are presented and considered:*

We can only comment on the presentation of proposals.

The technical content of new collaborative programmes is proposed by groups of industrial experts convened by the Commission and subject to peer review by open workshops. Committees of the Commission define the terms of reference and approve the programmes which are then submitted for financial approval by the European Parliament.

Once a programme is approved the call for proposals is issued and proposers days are held to brief potential consortia.

Submitted proposals are evaluated for technical content by groups of outside experts by the Commission. The Commission then enters into negotiation with the more highly ranked consortia according to the available finance. The final outcome of negotiations being subject to approval by the relevant EEC committees.

Thus constructive participation in the decision making process can influence the final outcome.

- (v) *The forums in which the decision to participate in ISPs is normally reached:*

As far as the collaborative R&D programmes sponsored by Brussels are concerned, there is no single forum. There are discussions between industrial concerns, between companies with relevant technologies needed to advance a concept and independent decisions by those companies to collaborate based on perceived market and financial opportunities.

- (vi) *Treasury/Cabinet Office guidelines—how they apply and how widely they are known and accepted:*
We are not aware of any guidelines relating to industrial collaboration through the CEC.
- (vii) *Treasury rules of “additionality”—how they apply and how widely they are known and accepted:*
These rules do not apply to CEC ISPs. The programmes are driven by strategy proposed by Industry itself.
All additionality criteria are positive encouragements to engage in fanciful scientific activities which rarely lead to short term market opportunities and may not result in any market opportunities at all. The DTI seems to be realising that the policy of additionality is unworkable.
- (viii) *Impediments within the UK to engaging in ISPs, e.g., Treasury rules, relative UK salary scales, housing, travel and family charges, commercial secrecy and intellectual property rights:*
There are no impediments of this type for CEC sponsored collaborations.
However we are well aware that the UK attitude to and performance in funding the European Space Agency directly affects the participation of the UK in the scientific programmes and in procurement for specific missions.
Relative salary scales do not become an issue in CEC supported industrial collaborations. We are aware however that the tax-free international salaries paid to scientists working at the site of an ISP do distort salary levels in that field in the UK. It can be argued that the UK suffers because it cannot subsequently encourage some of the very fine engineers on contract to an ISP to turn their attentions to other industries. Some of the finest electronic engineering takes place in Radio Astronomy Institutes, some of the best optical and mechanical designers are employed in Space Science Institutes.
- (ix) *Impediments in other countries to their engaging in ISPs (EEC; Commonwealth; USA; Eastern bloc) e.g., concern with national benefit and protectionism, COCOM restrictions, problems posed by national budgetary procedures:*
We have no comments of fact other than the obvious problem of IPR in Eastern block countries. The price we and every other industrial concern pays for collaboration is shared IPR (on a much larger scale than we would afford on our own of course). Without protection and the back-up from a common legal system we are all wary of near-market involvement with Eastern bloc countries.

Evidence from the commission of the European Communities

1. European Community Research and Technological Development (RTD) programmes are based on the principle of “subsidiarity”. That is, programmes are set up only when there is clear added value to be derived from performing such research on a European scale. Most research is best defined and performed by the organisations directly concerned, be they companies, research institutes or universities. Where there is need for public research activity, this will often be most appropriately carried out at national level in the Member States. European Community RTD accounts for some 2 per cent of the total carried out in the Member States and approximately 4 per cent of publicly funded research in Europe. The UK, together with the other Member States of the Community is closely involved in defining the areas of activity where such research is best done at the Community level and where the Community added value is evident.

2. There are a number of types of research for which Member State participation is best carried out at the Community level. First, there are research activities on a very large scale for which individual Member States could not, or could only with difficulty, provide the necessary financing and personnel. This is the case for example in the field of controlled thermonuclear fusion. Another type is the kind of research which concerns problems of a transnational nature. Examples are environmental problems, such as global warming, pollution of the North Sea or acid rain. Similarly, it is appropriate to carry out at Community level research, the joint execution of which offers obvious financial benefits, even after taking into account the extra costs inherent in all international co-operation. Examples are the fields of information technologies or new materials. In these areas, the pooling of skills, ideas and financial resources throughout the Community has a clear multiplier effect for the participants. The bringing together of different disciplines, organisations and nationalities helps to create business and scientific networks and contacts which retain their importance after the research programme or project has finished. Evaluations of Community programmes have shown, for example, that companies initially participate mainly for financial reasons. Those companies that have already participated in such programmes continue to do so largely because of the business and scientific contacts that they gain from working in an international programme. Research which is required to provide the scientific basis for the setting of standards and regulations at the Community level (“pre-normative” research) is also best performed at Community level. This particular category of research is gaining in importance with the approach of the Single Market in Europe in 1992.

3. Apart from the obvious financial advantage to be gained by pooling resources to tackle a common research problem, hosting large facilities is advantageous for a Member State as it creates or strengthens a pole of excellence and a concentration of high-level scientists. Evidence has shown that the development of good scientists and technologists is often closely linked with their ability to interact directly with other high

calibre people. This can be regarded as the indirect spin-off from hosting a large scientific facility. More directly, the presence of such facilities provides opportunities for local scientific suppliers, construction companies, etc. A good example of such a facility in the UK is the Joint European Torus (JET), located in Culham.

4. Depending on how the facility is staffed, there are also possible difficulties to be taken into consideration when hosting large international research facilities. Frictions may occur between indigenous staff of such facilities and those recruited from outside the host country. To staff a truly international facility, conditions must be set at a level which will attract scientists from all Member States, including the higher wage countries. Some problems related to the different status of staff from the UK Atomic Energy Authority and those recruited on a Euratom basis have arisen in JET.

5. The machinery whereby the European Community RTD programmes are set up is well known. The Community decision process involves a large consultation exercise, involving scientific and technical experts from industry, universities, research centres and Member State governments. The final decision process involving the Council of the European Communities in co-operation with the European Parliament is defined by the Treaties and gives the opportunity for all of the interested bodies in the UK and the other Member States to be consulted and to deliver their opinion before the final decision. For the UK, the role of the Cabinet office staff responsible for science and technology and the staff in the individual Ministries is very important. The Cabinet office acts as the co-ordinating body at national level and also contributes to the Community decision process through its participation in the meetings of the Committee for Scientific and Technical Research (CREST). In addition, the various government departments and ministries most directly concerned by EC RTD programmes are regularly involved in consultations over the content of the programmes and in their implementation through their membership of the consultative and management committees set up for the different programmes. The UK ministries most directly involved with Community RTD programmes are the Department of Trade and Industry (DTI), the Department of the Environment (DOE), the Department of Education and Science (DES), the Department of Energy (DEn) and the Ministry of Agriculture, Fisheries and Food (MAFF). Apart from *ad-hoc* consultation of the industries most concerned, the Commission's Industrial Research and Development Advisory Committee (IRDAC) also regularly delivers opinions on the strategy for and contents of Community research. IRDAC members are senior industrialists serving in a personal capacity and represent neither their industry nor their Member State. In addition, the Committee for the Development of Science and Technology (CODEST) also advises the Commission on the formulation and implementation of its programmes, in particular those concerned with fundamental science, large installations and mobility of researchers.

6. The criteria used to select Community RTD activities are laid down in Annex III of the multi-annual Framework Programme. Annex A sets out these criteria as currently formulated in the 1990-1994 Framework Programme. Annex B sets out the criteria used to select projects within the individual Community RTD programmes.

7. When the launching of a specific RTD programme has been decided on by Community institutions, the participation of UK research institutions, universities and firms is a "bottom-up" process, with any natural or legal person established in the UK being eligible to submit proposals. UK government departments and Research Councils are active in disseminating information on Community programmes to potential participants and in helping them to prepare proposals in response to the calls for proposals published by the Commission. A notable, but not exclusive, example is the use of national "contact persons" in the BRITE/EURAM programme.

8. Applications for funding under Community programmes are examined according to the selection criteria outlined in Annex B. The proposals are examined by panels of independent expert evaluators drawn from industry, research institutes and universities in all the Member States. The UK participates on the same basis as all other Member States. After the expert assessment of the proposals, the final choice of the projects to be funded is normally made by the Commission, taking full account of the views of the programme advisory or management committees, on which all Member States are represented.

9. The philosophy lying behind Community RTD actions is that common efforts complement (i.e., do not replace) what is done at national level. Therefore the rule of "attribution", if applied, would tend to reduce the net benefit to British scientists of access to Community programmes. It is not clear, however, whether the attribution rule, or the threat of the use of attribution, actually leads to any reduction in the level of interest of UK organisations in Community research. UK organisations submit at least as many high quality proposals as do the organisations of any other Member State and are notably successful in being selected for funding.

10. Normally, only organisations or researchers based in Community countries may participate in Community RTD programmes. Where mutual benefit can be identified, non-Community organisations may sometimes participate. Certain programmes are open to non-Community participation on a project by project basis or to organisations from specified non-Member States. For project by project participation, the non-Community organisation pays its own share of the funding and contributes to general administrative costs. In the case of non-Member State participation in a complete programme, the country

concerned contributes to the overall costs of the programme. The decision to allow or not allow the participation of non-Member States in Community RTD programmes is usually taken on the basis of industrial and commercial or scientific grounds, depending on the nature of the programme. In general, competition issues may be an impediment to non-Community countries participating in Community scientific programmes.

In general, publicly funded international scientific programmes (ISPs) concern research at a stage well before competitive aspects start to have any importance. However, occasionally initiatives (such as the recent Japanese Intelligent Manufacturing Systems proposal) do require serious consideration to be given to the likely effects of participation on the long-term health of European industry.

Inadequate scientific capacity and infrastructure may also be an impediment to engaging in ISPs; this problem is largely confined to the developing countries and some Eastern bloc countries. The Community's programme on Science and Technology for Development and the recently proposed programme on Life Sciences and Technologies for Developing Countries aim to help to overcome some of these problems in the developing countries by associating scientists from these countries with high-level scientists from the Community. These are the only Community RTD programmes which provide for Community funding to be given to non-Community participants. Particular activities to encourage scientific and technological co-operation with the countries of central and eastern Europe are currently being formulated within the Community.

Brussels,

22 August 1990

ANNEX A

SELECTION CRITERIA FOR COMMUNITY RTD ACTIONS (ANNEX III OF FRAMEWORK PROGRAMME, 1990-94)

In general, Community research and technological development (R&TD) actions should be selected on the basis of scientific and technical objectives, their scientific and technical quality and their contribution to the definition or implementation of Community policies.

A particular aim of Community R&TD shall be to strengthen the scientific and technological basis of European industry—including that of small and medium-sized undertakings—especially in strategic areas of high technology, and to encourage it to become more competitive at international level.

Community action can be justified where it presents advantages (added value) in the short, medium or long term from the point of view of efficiency and financing or from the scientific and technical point of view as compared with national and other international activities (public or private).

The following criteria in particular justify Community action:

- Research which contributes to the strengthening of the economic and social cohesion of the Community and the promotion of its overall harmonious development, while being consistent with the pursuit of scientific and technical quality;
- Research on a very large scale for which the individual Member States could not, or could only with difficulty, provide the necessary finance and personnel;
- Research, the joint execution of which would offer obvious financial benefits, even after taking account of the extra costs inherent in all international co-operation;
- Research which, because of the complementary nature of work being done nationally in part of a given field, enables significant results to be obtained in the Community as a whole in the case of problems whose solution requires research on a large scale, particularly geographical;
- Research which contributes to the achievement of the common market and to the unification of the European scientific and technical area, and research leading, where the need is felt, to the establishment of uniform rules and standards.

ANNEX B

SELECTION CRITERIA FOR SELECTING PROJECTS TO BE SUPPORTED IN A COMMUNITY RTD PROGRAMME

(Extract from: EC Research funding, a guide for applicants, CEC, Brussels, January 1990).

The selection of projects from the large number of applications requires careful and expert scrutiny. The selection criteria form the basis for the selection procedure. However, some degree of flexibility is deliberately incorporated in the programme descriptions, so that new research approaches can be accommodated, and to be fair to potential applicants from all EC Member States.

The Commission places great value on involving independent experts in the selection procedures. On the one hand it bases its decisions on the judgment of these qualified experts; on the other there are committees for the individual programmes on which representatives of all EC Member States sit. The primary role of these committees is advisory.

The selection of projects for all programmes is based on the following criteria:

- Compliance with the aims of the programme.
- Cross-border character.
- Scientific and technical quality and originality.
- Innovative potential.
- Industrial relevance and influence on competitiveness.
- Feasibility of implementation.
- Scientific qualifications of the applicant.
- Pre-competitive character.
- Amount of EC funding.
- Composition of the partnership.

In addition, there are specific criteria for the individual programmes, and these vary according to the stated objectives.

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